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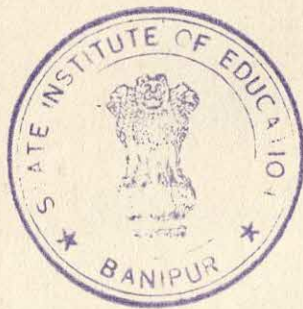
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The
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Unabridged



Volume 9

PEN-ROTHENSTEIN

AN ILLUSTRATED TREASURY OF KNOWLEDGE

Publishers Company, Inc.

Washington, D.C.

Key to Pronunciation

VOWELS

ă (short), as in *hat, cat*.
ā (long), as in *ale, hate*.
ã (Italian), as in *car, mar*.
à (short Italian), as in *fast, class*.
ɑ (broad), as in *all, fall*.
â (circumflex), as in *care, snare*.
a or *q̃* (short obscure), as in *final, spinal*.
â (long obscure), as in *surface*.
ae, as in *Caesar*, = *ē*.
ě (short), as in *net, met*.
ē (long), as in *me, eve*.
ê (circumflex = *â*), as in *there*.
ẽ (tilde), as in *her*.
ę or *ɛ* (short obscure), as in *patent*.
ê (long obscure), as in *delay*.
ë = *ĩ*, as in *pretty*.
ĩ (short), as in *hit, bit*.
ī (long), as in *kite, mite*.
ĩ (tilde), as in *sir*.
ı (short obscure), as in *habit*.
ı̇ (long obscure), as in *idea*.
õ (short), as in *pop, hop*.
ô (long), as in *cone, bone*.

ó (circumflex = *q̃*), as in *for*.
ô (long obscure), as in *hero*.
õ (short), as in *book, brook*.
ō (long), as in *moon, spoon*.
o = *û*, as in *word*.
ô = *ũ*, as in *son*.
oe, as in *Phoebe*, = *ē*.

ũ (short), as in *rut, cut*.
ū (long), as in *muse, fuse*.
û (circumflex), as in *turn, urn*.
û (long obscure), as in *unite*.

w is a vowel only after a vowel, when it forms the second element of certain diphthongs, as in *few, how*.

ÿ (short) = *ĩ*, as in *hymn*.
ȳ (long) = *ĩ*, as in *by, cry*.

CONSONANTS

ε (hard) = *k*, as in *cat, cape*.
ç (cedilla) = *s*, as in *cell, façade*.
ĝ (hard), as in *dog, gave*.
ĝ (soft), as in *gem, gentle*.
ķ for the German *ch*, as in *ich, Bach* (*bäk*); also = *e*

ü for the German *ü*, as in *Blücher, Grünberg*.
ö for the German *ö*, as in *Göttingen*.
ñ for the French *n*, as in *bon, Bréton* (*brã-tông*).
th (soft), as in *path*.
TH (hard), as in *the, father*.
ñ for the sound of *ny*, as in *canyon*.

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MANUFACTURED IN THE U. S. A.



Pen (*pĕn*), a writing instrument using fluid ink. Forerunners of modern pens were the metal styluses used by the ancients for scribing stone, metal, and waxen tablets. Ink was used from early times in China, being applied with a hair brush. Reed pens, used for writing upon papyrus in old Egypt and its neighboring civilizations, are still employed in the region. Quill pens came into general use with the manufacture of writing paper during the Middle Ages. Most commonly, the quills were obtained from the wings of geese and were dried and treated with alum or nitric acid solutions to harden them before cutting them with a pen-cutter's knife.

Steel pens were first manufactured in the early part of the 19th century, and originally were made to resemble the quill pen, forming a barrel of very thin steel, being cut and slit in the manner of a quill. The principal fault was their hardness, which caused them to scratch the paper. James Perry is believed to be the first maker of the steel slip pen, and in 1828 he combined with Josiah Mason in the manufacture of barrel and steel slip pens. In 1831 Joseph Gillott introduced marked improvements in the manufacture of pens, by which he was able to make them of much thinner sheets of steel and thus render them more elastic, at the same time giving them higher finish and temper. His factory at Manchester, England, became an important seat of pen making, and the price was so materially reduced that at about 1835 1,000 pens could be purchased at the price of a single pen made by manufacturers at the same place in 1803. Other improvements in pen manufacture speedily followed, and within a very short time steel pens came into general use. The first pen manufacturing company in the U.S. was the Esterbrook Co., founded at Camden, N.J., about 1860. The process of manufacturing involves a variety of operations, including the rolling of the best quality of cast steel into sheets, cutting them into flat pieces called *blanks*, and afterward stamping and embossing them. An emery wheel is used to finish the nibs or points, after which the slit is cut, and the pens are glazed with a varnish and boxed for the market.

The nibs of gold pens are made by tipping them with iridium, one of the hardest of metals, after which they are ground down on an emery wheel and polished. *Fountain pens*, having a reservoir from which the ink feeds by gravity to the point, were invented by Joseph Bramah in 1809. L.E. Waterman patented an automatic underfeed pen in 1884, but it was not until 1908, however, that the first successful *self-filling* pen was patented by W.A. Sheaffer. There are two main types of filling mechanisms on present-day fountain pens, the lever and the vacuum styles. Numerous types of pen points are manufactured to meet the needs of different kinds of handwriting.

The *stylographic* pen, which has never been very practical or popular, has a reservoir to hold the ink, but the fluid escapes when the pencil-shaped point is pressed upon the paper. A similar writing instrument, the *ball-point pen*, was introduced in 1945 and has been somewhat more successful. This pen operates on a ball bearing and uses an ink similar to printing ink. It utilizes a completely replaceable writing unit and requires refilling only once every two to four years. Pen making is now an important industry. Extensive factories are maintained in which millions of pens are made annually for home use and for exportation. The principal factories of North America are located in Ft. Madison, Ia., Janesville, Wis., Chicago, Ill., and New York City.

Penance (*pĕn'ans*), one of the seven sacraments (*q.v.*) of the Roman Catholic Church. Penance, which is accessible only to baptized Christians, is brought about with the aid of a priest and is accomplished by the successive steps of contrition, confession, a voluntary act of reparation and, finally, absolution. The Greek Orthodox Church also regards penance as one of the sacraments, but the Anglican Church considers it as merely an act of private devotion.

The institution of penance was only gradually developed. During the first century after Christ, penance constituted a public act pertaining especially to the remittance of such sins as homicide, impurity and apostasy. There were no set rules about the performance of the rite. As a sacrament, penance was first outlined in the 12th century by Peter Lombard and Thomas Aquinas. At the Councils of Florence and Trent (15th and 16th centuries) penance was finally instituted as an integral part of the Catholic faith. See also *Absolution*; *Contrition*; *Reparation*.

Penang (*pĕ-nāng*'), or PRINCE OF WALES ISLAND, an island in the Federation of Malaya, situated near the west coast of the Malay Peninsula, in the Strait of Malacca; 375 m. N.W. of Singapore. It is about 15½ m. long and 10½ m. wide and has an area of 108 sq. m. The surface is partly mountainous, but consists in part of fertile plains. It is well watered and has a favorable climate. Among the principal products are tea, rice, coconuts, rubber, copra, and fruits. Minerals are found in the mountains, especially tin ore. In all parts of the island valuable forests are found. Georgetown is the capital and principal seaport. The inhabitants consist mostly of Chinese, Malays, and Burmans. Mohammedanism is the chief religion, but many natives are Christians. During World War II, the Japanese occupied Penang; it was retaken by the British in 1945. Penang is a state in the Federation of Malaya, formed in February 1948. Population, 1947, 446,321.

Pencil (*pĕn'sil*'), instrument used for drawing,

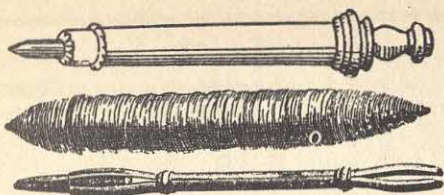
writing, or marking; usually a slender casing of wood, or metal case with tapering end, enclosing a thin core of graphite, lead, slate, or a combination of several materials, in black or colors. Also, a relatively large cylindrical stick of one of these materials, or of chalk or crayon, without a casing, such as the old-time slate pencil. Historically and technically, a pencil may be a very small and fine hair brush used by artists for laying on their colors. The ancient Romans used a kind of tiny brush—which they called a *penicillus*, or “little tail”—for painting fine outlines and writing on papyrus, thereby providing the name we use today for our lead pencils, long made without actual lead.

In ancient Egypt, Greece, and Rome, metallic lead was used in the form of a small disk for ruling guide lines on papyrus to keep the lettering even. This implement, called a *plumbum* (Latin for “lead”) was mentioned by Pliny in his writings. Eventually—history does not say just when—the lead was shaped into a thin rod and employed for writing as well as for drawing fine lines. It is known that such pencils were in use by the 14th century, primarily as artists’ tools. Rods of zinc or silver were used, making a sort of pale gray drawings, now classified as “silver point” drawings.

Cortez reported in 1520 that the Aztecs of the New World used a kind of lead crayon, but it is not until 1565 that mention occurs of the now familiar “lead pencil” in which a writing core is enclosed in wood. A year before that (1564), a discovery had been made which was to take the “lead” forever out of pencils, except for the name. A deposit of graphite—pure black carbon—was found at Borrowdale in England in a form so solid and uniform that it could be sawed into sheets and then into square leads. Called *plumbago*, or “that which acts like lead,” this pure graphite was the only such deposit ever found, and its value was fantastic. Mined only six weeks a year, the ore was moved to London under armed guard, and its export was prohibited. The English Guild of Pencil Makers enjoyed a world monopoly on the pencils, with their hand-carved wooden cases enclosing the leads. By 1850 the Borrowdale mines were exhausted and pencil makers had to rely upon the less pure deposits of graphite which had been found in other parts of the world. The Germans had been the first to solve the problem of making usable sticks from this ore, which had to be crushed to remove the impurities and then re-formed into leads by means of a suitable binder. By the 17th century they had developed a secret formula for a mixture of graphite, sulfur, and antimony which enabled them to compete with the English pencils. In 1761 the Fabers established a factory in Nuremberg where extensive graphite deposits occur.

The basis for the present lead-making process was discovered in 1795, at a time when France had been cut off by war from both English and German sources of pencil supply and Nicholas Jacques Conté, an officer in Napoleon’s army, was commissioned to develop a substitute for the imported leads. By mixing powdered graphite with powdered clay and firing the mixture like china in a kiln, a serviceable lead was produced which also could be graded from hard to soft by varying the proportion of graphite to clay. A similar process was invented by William Monroe, first known manufacturer of lead pencils in the U.S., who introduced his product (1812), with the leads encased in cedar. Other native pioneers were L.M. Leman (1830), Joseph Dixon, and Henry Thoreau who ran a small pencil factory in the 1850’s. In 1849, A.W. Faber, of Stein, Germany, opened an agency in New York, and in 1881 established a large factory there. The Eagle Pencil Co., with a long history of pencil inventions, was founded in 1856. The period from the end of the Civil War to the turn of the century saw the development of this country’s pencil industry to its present position of international importance, bringing in raw materials from every corner of the globe and shipping out the many improved and specialized types of pencils in use today.

Pencil “leads”—which contain no lead—are made of a mixture of graphite and clay. Graphite (carbon, more or less pure) is mined in various countries of both hemispheres. An especially pure deposit exists at Ticonderoga, N.Y. An ideal combination for production of smooth black leads results from blending smooth oily flakes of crystalline graphite from Ceylon and Madagascar with an amorphous graphite from Mexico which is powdery, formless, and very black. This graphite mixture, ground so fine that the particles float in air, is mixed with specially selected clay which has been pulverized and sent through a series of settling tanks until only the finest particles remain. This blend goes through a long grinding process, forming a paste from which the water is squeezed out in filter presses. The solid mass resulting is forced through a cylinder with a perforated base plate, coming out in the form of long black shoestrings which are collected in a mass and hammered into another cylinder. Under many tons of pressure, the mixture is then forced through a diamond die in the bottom of this cylinder, which has one hole the size of the finished lead. The material passes through this hole in the form of a continuous string which is laid on boards to dry, then cut into pencil lengths, packed in crucibles, and fired for many hours in electrically controlled furnaces to temper the leads. These vitrified leads are next steeped in hot waxes until every particle of graphite and clay is coated with a film of lubricant, thus reducing



Courtesy American Pencil Co.

EARLY FORMS OF THE LEAD PENCIL

The first known lead pencil (*top*) consisted of a wooden tube holding a piece of graphite. Cord, however, was one of the most common of the early coverings for graphite (*center*). A port-crayon or metal holder for graphite (*bottom*) was introduced in the 18th century.

writing friction. A recent improvement, designed to prevent point breakage, surrounds the lead with a thin impervious coating which allows a firm bond between the wax-impregnated lead and the wood case, at the same time preventing oil absorption by the wood.

Cedar, the wood traditionally used for pencil cases, is sawed into small slats, each the length of a pencil, but only half its thickness, and about 6 in. wide. After thorough seasoning, these slats are run through a grooving machine which cuts six parallel grooves the shape of the leads, and half as deep. To prevent splitting, the grooves are impregnated with a resinous binder. The leads are then placed in the grooves, and glue is applied to a matching slat which has been similarly grooved and treated. The slats are pressed together to form a "lead sandwich," thoroughly dried, and then fed into a shaping machine which divides each sandwich into six pencils, round or hexagonal in shape. Smoothed by sandpapering, covered by many coats of lacquer, with ends cleanly sandpapered, the pencils are ready for hot-stamping with the maker's brand and the degree of hardness. Plastic or brass tips may be added; also erasers made from a compound of rubber and abrasive, vulcanized for strength, cut to length, and tumbled until the edges are smooth. Pencil, tip, and eraser are assembled by machine, and the pencil is ready for packaging. They are usually numbered according to the degree of hardness, 1, 2, 3, 4, etc., the larger numbers representing those having harder leads than No. 1—that is, more clay in proportion to graphite. Letters are sometimes employed for the same grading purpose.

In recent years refillable metal pencils, with automatic devices for feeding the lead through a tapered tip (first patented in 1879), have been widely and increasingly used. Another type of casing consists of a sheet of paper with part of its width cut into narrow strips and wound around the lead until the pencil is of average size. Lacquered on the outside, this paper can be unwound

PENDULUM

from the tip to reveal more of the lead as it is worn down by use. This is applied usually to colored leads, or to marking pencils, where the lead core is of more than ordinary thickness.

Special research has resulted in ingenious machine methods for testing and grading drawing pencils, which can now be turned out in many accurate degrees of hardness. The indelible pencil, composed of clay and gum colored with an aniline preparation (invented in 1877), has been perfected for use in every variety of manifold and copying work. Colored pencils have been developed from brittle and unreliable sticks of natural-earth pigments to a rainbow of shades in leads of usable strength and uniformity of color, with pigments tested for resistance to fading. These colored leads—now usually encased in wood—are formed by mixing pure white kaolin with waxes and pigments or dyes. The ingredients are thoroughly ground, dispersed in a smooth compound, and extruded by much the same process as that used for the graphite lead, but these are not fired. Instead, they are carefully dried for long periods in air-conditioned rooms where temperature and humidity are accurately controlled.

Pend d'Oreille (*pān dō-rā'*), a tribe of American Indians. See *Kalispel*.

Pendergast (*pēn'dēr-gäst*), THOMAS JOSEPH, politician, born in St. Joseph, Mo., July 22, 1872; died in Kansas City, Mo., Jan. 26, 1945. Identified with Kansas City in later life, he moved there, as a young man, in 1893. Pendergast rose from the political ranks of street commissioner and deputy marshal to become a city councilman and the "boss" of the Kansas City Democratic organization. His one-man "rule" ended in 1939 when he pleaded guilty to a charge of income-tax evasion. The Pendergast machine is said to have helped the election of President Harry Truman (*q.v.*) to many of the positions he held in Missouri.

Pendleton (*pēn'd'l-tūn*), county seat of Umatilla County, Oregon, on the Umatilla River, 230 m. w. of Portland. It is on the Union Pacific and Northern Pacific R.R.'s. The surrounding country has large interests in farming and stock-raising. Extensive water power for industrial purposes is supplied by the river. The county courthouse, two academies, and a number of churches are among the buildings. The manufactures include flour, wool, lumber, saddles, and machinery. The town was incorporated in 1880. Population, 1940, 8,847; in 1950, 11,774.

Pendulum (*pēn'dū-lūm*) (from Latin *pendulus*, "hanging, swinging"), a body so suspended from a fixed point that it may swing freely back and forth. Pendulums are divided into the classes *simple* and *compound*, possess interesting characteristics, and exist in several modifications.

The characteristics of pendulums may be under-

PENDULUM

stood from a consideration of the simple pendulum which, in the ideal case, consists of a small body called a "bob" (*c*) suspended from a fixed point (*a*) by a string or rod (*b*) whose mass is negligible compared to that of the bob and whose length is very much greater than the dimensions of the latter. The bob is usually a small heavy sphere and all of its mass is considered to be located at its center. The to-and-fro movements of the bob are called vibrations or oscillations and execute a vertical arc. They are described by indicating their *amplitudes* (displacement from a mean position) and *periods* (the time required for the bob to execute one complete movement, i.e., the time elapsed between two passes through any point in the same direction). When the bob reaches a maximum displacement, it has a maximum potential energy; when it passes through the rest position, it has a maximum kinetic energy (energy due to acceleration). If there were no dissipation of energy due to friction or other causes, all the potential energy of the bob would be converted into kinetic energy and vice versa, with the result that the bob would continue to vibrate forever with no diminution in amplitude.

When the amplitude of vibration is small the period is independent of both the mass of the bob and amplitude of vibration of the pendulum. However, the period depends on the length of the string and the acceleration due to gravity as indicated by the following equation:

$T = 2\pi\sqrt{l/g}$ where T is the period in seconds, π has the value 3.1416, l = length in centimeters, and g = acceleration due to gravity. This means that a pendulum vibrating with a period of two seconds would have a string one-fourth as long as one vibrating with a period of four seconds.

This equation also indicates that the period of vibration depends on the acceleration due to gravity. Since this is different at different places on the earth's surface, the period of vibration of a pendulum of given length would vary accordingly. Thus a pendulum one meter in length would have a period of 2.0095 seconds at the



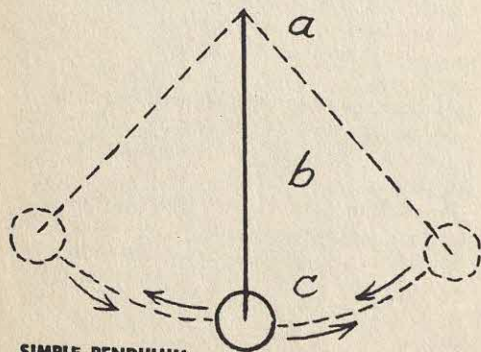
GRID PENDULUM

equator (Domjo Ndorobbo, Africa), 2.0070 seconds at Washington, D.C., and 2.0043 seconds at Sorvaagen, Norway (see *Escapement*).

A compound pendulum consists of a body of any shape or size vibrating around a horizontal axis. The mass may not be considered to be located at one point and the motion of the body is rotational rather than translational as in the simple pendulum.

Modifications of the simple pendulum were used in clocks. The great difficulty was encountered in keeping the length of the rod constant since practically all materials undergo some expansion or contraction with change in temperature. An increase in the length of the pendulum causes the clock to run slow. This difficulty is overcome in some clocks by having a mercury bob so constructed that when heat causes the rod to expand and lengthen, it also causes the mercury to expand and rise in a tube to such an extent that the center of gravity of the bob rises and hence the distance from support to center of gravity of bob remains the same. When temperature is lowered opposite changes occur. A second way of compensating for the same change is employed in the grid pendulum (see figure). The "rod" consists of a grid composed of 3 rods (dark) whose expansion lowers the bob and 2 rods (light) which raise it. If the rods used have coefficients of expansion in the ratio of 2 to 3, the rod remains the same length at all temperatures. A combination of brass and iron rods is used.

Another interesting application of a simple pendulum is the demonstration of the rotation of the earth. A pendulum vibrating in a definite plane resists a change in its plane of vibration. Thus a pendulum at the North or South Pole would continue its vibration in a fixed plane while the earth rotated under it. To an observer, the path of the swinging bob would appear to rotate through 360° every 24 hours. The amount of the apparent rotation of the pendulum in a given time will vary with location, being greatest at high latitudes and decreasing toward the equator. This phenomenon was demonstrated by Foucault.



SIMPLE PENDULUM

4975

737.

PENELOPE

Penelope (*pē-nēl'ô-pē*), in Greek legend, the wife of Ulysses (Odysseus) and mother of Telemachus. While her husband was absent, fighting in the Trojan War, Penelope was harassed by the importunities of numerous suitors, who had taken possession of his home and devoured his substance. Penelope deferred giving answer until she should have finished weaving a robe; and in order to gain time she secretly undid at night what she had done in the day, thus retarding completion of the work. Her stratagem was discovered by an angry suitor, but he was slain with the others by Ulysses, who had just returned from the war. Homer narrates this story of Penelope and Ulysses which has since exemplified conjugal faithfulness.

Penguin (*pēn'guĭn*), one of a family (*Spheniscidae*) of short-legged, flightless birds found mostly in the Antarctic, along the west coast of South America to the Galapagos Is., and on the east coast to the Falklands. Penguins have numerous, very small feathers, usually black over the head, wings, and back, and white over the breast and abdomen. There may be conspicuous yellow patches on the cheeks and neck. When swimming, the birds use their wings as paddles in an alternating rotary motion. The largest species, *Aptenodytes forsteri*, the Emperor penguin, stands well over 3 ft. high; the smallest, *Spheniscus minor*, only 19 in. When on land penguins, whose feet are located close together at the hind end of the body, walk upright. The black coat and white "vest" then give these birds a ridiculously human look. They are usually unafraid of man and can inflict painful bites. Penguins nest in colonies, often tens of thousands on one site. Some species build crude nests on the bare ground; others hold their eggs (usually a single egg) on their feet between their legs. The birds eat fish, crustaceans, squid, and seaweed. Young penguins are edible; and the adults are the source of a marketable oil.

Penicillin (*pēn-is-sil'in*), a potent antibacterial substance obtained from the culture liquor of the molds *Penicillium notatum* and *P. chrysogenum*, developed by Sir Alexander Fleming and Sir Howard Florey (*qq.v.*). Fleming noted that ordinary laboratory cultures of staphylococcus and streptococcus organisms showed striking growth inhibition when contaminated by the mold commonly seen on spoiled bread. From this simple beginning, research produced the pure crystalline product, sodium salt of penicillin soluble in pure water, saline, or dextrose solutions. The water-soluble potassium salt and the sparingly soluble procaine salt (both crystalline) were developed later and are now more widely used. The ordinary action of penicillin is *bacteriostatic* (inhibiting the growth of harmful organisms infecting the body) and in huge doses *bactericidal* (actually killing the organisms).



Courtesy Chas. Pfizer & Co., Brooklyn, N. Y.

PENICILLIN SOLUTION

A stream of the final penicillin solution comes from the separator

It has been established that penicillin is an excellent therapeutic agent for the following conditions: all *staphylococcal* infections, such as osteomyelitis (bone infection), carbuncles and abscesses, brain abscesses, pneumonia and lung abscesses, meningitis (infections of covering tissues of brain and spinal cord), wound infections and infected burns; all varieties of *gangrene*; all *hemolytic streptococcal* infections, either generalized or localized, including puerperal sepsis (infection and fever following childbirth); all infections caused by the *pneumococcus*, such as pneumonia and meningitis; all *gonococcal* infections (gonorrhea and complications); all *meningococcal* infections; and *bacterial endocarditis*—infection and inflammation of the valves and lining of the heart, commonly seen in those with severe rheumatic heart disease. It has been administered with success against syphilis. Penicillin has many advantages over the sulfa (*q.v.*) drugs, such as more striking and faster therapeutic effects, higher effectiveness in the presence of pus and products of tissue degeneration, and effectiveness against organisms which have become resistant to sulfa drugs. It is incompatible with other drugs. Penicillin is administered in a variety of ways (intravenously, intramuscularly, or locally), in divided doses, according to the type, location, and extent of the infection. It is excreted rapidly via the kidneys, and there are practically no side effects or toxicity. See also *Bacteriology*.

Peninsular Campaign (*pēn-in'sū-lēr kām-pān'*), the name given to a movement in the Civil War of the U.S., by which it was designed to capture Richmond, Va., the capital of the Confeder-

ate States. Gen. McClellan was appointed to command all the Federal troops in the vicinity of Washington, on July 21, 1861, and everywhere resounded the popular cry, "On to Richmond." The campaign proper began on Apr. 21, 1862, when McClellan landed his forces at Ft. Monroe and marched between the York and James Rivers toward Richmond, where Gen. Johnston was in command. The Federals had an army of 120,000 men. They spent a month in the siege of Yorktown, but all the Confederates escaped. On May 4, McClellan was successful in the Battle of Williamsburg, where he defeated Johnston. However, Stonewall Jackson, with an army of 20,000 Confederates, marched through the Shenandoah valley and gained victories at McDowell and Winchester.

A large portion of McClellan's army took a position at Fair Oaks, where Johnston made a vigorous attack but was repulsed and wounded. He was succeeded in command by Gen. Lee, who immediately sent reinforcements to Jackson in the Shenandoah valley. Then followed the engagements at Mechanicsville, Gaines' Mill, White Oak Swamp, Frazer's Farm, and Malvern Hill, known collectively as the Seven Days' Battles, and all were unfavorable to the national cause. In the last of these engagements, that at Malvern Hill, the Confederates sustained great losses and were defeated, but McClellan ordered a retreat to Harrison's Landing, where he reorganized his forces, but soon embarked for Washington. The Peninsular Campaign ended by the latter part of July, but Richmond had not been reached, although the Federals lost about 15,000 men. As a result of this movement, public confidence in the Federal army was weakened, while the Confederates gained strength in this respect.

Peninsular War, the name generally applied to a war waged by Napoleon for the conquest of Spain and Portugal. It was caused principally by a disagreement between Charles IV, King of Spain, and his son Ferdinand, in 1807, which Napoleon made the occasion of interference. Accordingly he placed on the throne of Spain his brother Joseph, who was proclaimed king on July 24, 1808. The royal family of Portugal had previously fled to Brazil, but the people of both Portugal and Spain rose against the French in all parts of the peninsula. Napoleon had stationed French troops at many strategic points and the people at first carried on a guerrilla warfare, but on July 12, 1808, a British army of 30,000 men was sent under Sir Arthur Wellesley, afterward Duke of Wellington, to aid in expelling the French. He landed at Figueras, Portugal, and on Aug. 21 defeated the French under Gen. Junot at Vimero. Wellesley was superseded in the command by Sir Harry Burrard, who soon after was superseded by Sir H. Dalrymple, and the latter on Aug. 30 con-

cluded the Treaty of Cintra, by which Junot agreed to evacuate the country.

Napoleon, being dissatisfied with the turn of affairs, sent large reinforcements to Spain and came in person to Madrid to direct his army. At that time Sir John Moore commanded the forces in Spain, and on Jan. 16, 1809, lost his life in the Battle of Coruna. Shortly thereafter Wellesley returned to take command of an army made up of English and Portuguese, when he was confronted by 375,000 French veterans. His operations were attended by a series of successful battles, the most noted being those of Salamanca in 1812 and Vittoria in 1813. On Oct. 7, 1813, the French were driven across the Pyrenees into France, and the war was concluded the following year by a decisive victory at Toulouse. In 1814 the veterans of Wellington's army were transported to America to take part in the campaign against the U.S.

Penmanship (*pēn'man-ship*), a term used to describe the artistic appearance of writing. From the time of the medieval manuscripts through to the middle of the 19th century, the form of individual letters and their connection, and the organization of written lines have been of great interest and study to writers and readers. Sheets and books have been compiled as examples, and the change in taste can be followed in the sequences of characters, just as any sequence of fashion in any field of applied art. The sample books of English and French masters in the 18th century became especially famous, George Bickham's "The Universal Penman" (London, 1741) being the foremost. See *Writing*.

Penn (*pēn*), WILLIAM, founder of the colony of Pennsylvania, born in London, England, Oct. 14, 1644; died at Ruscombe, England, July 30, 1718. He was the son of Adm. William Penn, studied at Christ Church, Oxford, and there joined the new sect of Quakers. He traveled a few years in Italy and France and later became a court favorite in England. In 1666 he managed an estate in Ireland for his father and was imprisoned at Cork for attending a meeting of Quakers. He became a minister of that sect, because of which he lost for a time the good will of his father, and in 1668 was imprisoned in the Tower for publishing a pamphlet entitled "The Sandy Foundation Shaken," which opposed the doctrine of the Trinity and other teachings of the Established Church. While in prison he wrote several works that attained to much popularity, among them "No Cross, No Crown" and "Innocency with Her Open Face." After seven months he was liberated through the influence of the Duke of York. The meetings of Dissenters were prohibited in 1670, but he continued active in spreading their doctrines and was again imprisoned. After refusing to take the oath of allegiance, which he did from

PENN

conscientious scruples about swearing, he was confined for six months at Newgate. Regaining liberty, he visited Germany and Holland for the advancement of Quakerism and, on returning to England, in 1672, married Gulielma, the daughter of Sir William Springett.

His father having died in 1670, Penn came into possession of an estate valued at \$7,500 per year and acquired a claim against the government for \$80,000. He continued his diligence in propagating the doctrines of his sect by preaching and writing, and in 1681 accepted from the government a grant of the region now included in the State of Pennsylvania in lieu of his monetary claim. It was especially provided that he should be at liberty to promulgate his religious and political views and to found such colonies as he desired. The region was named Pennsylvania in honor of his father at the suggestion of King Charles II. In August 1682, he and several friends sailed for the region of the Delaware, and on Nov. 30 they met with representatives of several Indian tribes for an interview on the present site of Philadelphia. The consultation ended in purchasing the lands from the Indians, who always held Penn in great reverence. He founded the colony on a democratic basis, extending to all a large degree of religious liberty, planned the city of Philadelphia, and administered the affairs of the colony with much wisdom and liberality. Under the policy of Penn all sects were allowed to settle in Pennsylvania and their religious and civil rights were respected, a course which caused many who were persecuted for expressing their views to seek refuge in his colony.

He returned to England in 1684. When the Duke of York succeeded to the throne as James II, Penn became highly influential at the court, and through his efforts a large number of Friends were liberated from prison. After the Prince of Orange succeeded to the throne, Penn continued on intimate terms of friendship with the abdicated monarch, and was accordingly charged with treason in 1689. This charge was removed and he was honorably acquitted in 1693. In 1699 he made a visit to his colony in Pennsylvania, when he improved materially its industrial conditions, brought about a more satisfactory state of affairs in the government of the same, and bettered the relations between the colonists and the Indians and Negroes. He returned to England in 1701 to personally look after the interests of his estate, which had been left to the management of a man named Ford, who had wasted many of the resources and left extortionate claims against Penn. Refusing to pay some of these claims, Penn was thrown into the Fleet prison in 1708, from which his friends soon after released him. His most important writings include "The Great Cause of Liberty of Conscience," in which he defended



Courtesy Brown Bros., N. Y.

WILLIAM PENN

the doctrine of toleration. He died of paralysis and was buried near the village of Chalfont St. Giles, in Buckinghamshire.

Pennacook (*pĕn'-ă-kōōk*), a confederation of Algonquin Indian tribes, formerly dwelling in the vicinity of the Merrimac River in New Hampshire and Massachusetts. Their capital was at Amoskeag, now Manchester, N.H. Siding at first with the English, by whom they were deprived of their lands, they later joined the French and were driven from their home territory in the colonial wars of 1675-76. Their language resembled that of the Penobscots (*q.v.*). Their descendants are to be found at the Indian settlement of St. Francis, in Quebec Province, Canada.

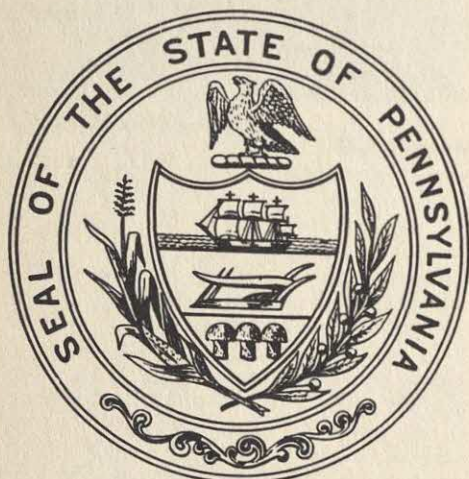
Pennant (*pĕn'-ant*), naval flag, triangular or bifurcated, employed in signaling, or as decoration, or, in sports, a small flag denoting championship.

Pennell (*pĕn'-nĕl*), JOSEPH, etcher and illustrator, born in Philadelphia, Pa., July 4, 1860; died in Brooklyn, N.Y., Apr. 23, 1926. He developed skill in drawing at an early age. Much of his work was done with the assistance of his wife. The two traveled extensively in Europe, where he was arrested in 1891 by officials in Russian Poland on suspicion of obtaining pictures of forts. They published a series of illustrated works, including: "Two Pilgrims' Progress," "The Stream of Pleasure," "Play in Provence," and "To Gypsyland." He wrote "Pen-Drawings and Pen-Draughtsmen" and illustrated Sterne's "Sentimental Journey" and Justin McCarthy's "Journey to the Hebrides."

PENNINE ALPS

Pennine Alps (*pēn'in*), a division of the Central Alps, extending from Great St. Bernard Pass to Simplon Pass, along part of the boundary between Switzerland and Italy. The Pennine Alps include the peaks of Mt. Rosa (*ca.* 15,215 ft.), Weisshorn (*ca.* 14,805 ft.), and the Matterhorn (*ca.* 14,780 ft.).

Pennine Chain, a chain of hills in northern England, extending from southern Northumberland down to Staffordshire, often called the "backbone of England." The chain is actually a series of short ranges separated by river valleys, such as the Tyne, Tees, and Aire, and forming a north and south watershed which determines the course of the larger rivers in northern England. There are a few lakes, many caverns, and some chasms (more than 300 ft. deep). The highest peak is Cross Fell (2,930 ft.) in Cumberland.



Pennsylvania (*pēn-sil-vā'ni-ā*), a state in the Middle Atlantic section of the U.S., one of the 13 original states of the Union, and the second to ratify the Federal Constitution. It has had a distinguished history and a diversified economy ever since its founding.

Pennsylvania is bounded on the *n.* by Lake Erie and New York, on the *e.* by New York and New Jersey, on the *s.* by Delaware, Maryland, and West Virginia, and on the *w.* by West Virginia and Ohio. The entire eastern boundary is formed by the Delaware River, and the entire southern boundary by Mason and Dixon's Line. It ranks 33rd in size among the states and third in population, according to the 1960 Decennial Census of Population (the District of Columbia is included in both of the above rankings). The state's name, meaning "Penn's Woods," was given it by King Charles II of England in honor of the father of its founder, William Penn. Its nickname is the "Keystone State," from

PENNSYLVANIA

its central position and strategic importance among the colonies (six of the colonies lay north of it, and six south).

Location	Between 74°43' and 80°31' W. long. and 39°43' and 42° N. lat
Area	45,333 sq. m.
Land	45,007 sq. m.
Inland water	326 sq. m. ¹
Greatest extent:	
North to south	158 m.
East to west	302 m.
Population (1960)	11,319,366
Capital city	Harrisburg
Highest point	Mt. Davis, also called Negro Mt. (3,213 ft.)
Lowest point	Sea level (Delaware River)
Entered the Union (2nd State)	1787
Flower	Mountain laurel
Bird	Ruffed grouse
Motto	"Virtue, Liberty, and Independence"
Flag	See color plate in Vol. XI

¹ Including part of Lake Erie, the water area is 1,061 sq. m., bringing the total area to 46,068 sq. m.

GEOGRAPHY

Most of the Pennsylvania countryside varies from hilly to mountainous. The state falls into five fairly distinct geographical regions. (1) A very small part of the extreme southeastern section, around Philadelphia on the Delaware River, lies in the Atlantic coastal plain, virtually at sea level. (2) Inland from the Delaware, the ground rises rapidly into the undulating hills of the Piedmont Plateau, the oldest and most worn-down section of the Appalachian region. This area, picturesque and very fertile, occupies approximately the southeastern one-sixth of the state. It may be broadly defined by a line drawn from Stroudsburg to Harrisburg to Chambersburg, following the south slopes of Blue Mt. A peculiarity of the Alleghenies is that a "mountain," instead of being an individual peak, is a long, high ridge so steep as to be impassable except at "water gaps" or by modern highway construction. The name usually includes its subsidiary hills, smaller parallel ridges. Thus, Blue



Mt. runs continuously (except for a major interruption at the Susquehanna gap, just north of Harrisburg) from Stroudsburg to Chambersburg, a distance of *ca.* 150 m. (3) The main range of the Allegheny Mts. crosses the state in a long, gently curving arc from northeast to southwest, covering an area *ca.* 250 m. long and from 20 to 80 m. wide. This extremely rugged mountain range is characterized by heavily wooded, high ridges separated by deep and narrow valleys, which make up a great deal of the coal-mining country. It is breached significantly only by the Delaware Water Gap and the gap of the Susquehanna River. A northward extension of the Blue Ridge Mts., known as South Mt., extends northeastward for *ca.* 40 m. from the center of the southern border. Between the east face of the mountains and the Piedmont Plateau, all across the state, lies an area known as the Great Valley, a fertile, well-watered region running all the way from New England to the Carolinas. The potentialities of this valley, beyond which lay the high mountain walls, diverted many early settlers from central Pennsylvania into Virginia and farther south. (4) North and west of the Alleghenies, most of the rest of the state—more than half its area—occupies a region known as the Allegheny (or Appalachian) plateau. This area is characterized by great rolling hills (high enough to be called "mountains" in other states), the eroded remains of an ancient plateau. The average altitude of this section ranges from 1,000 ft. to 1,500 ft. above sea level. Abundant rain and snowfall, and many lakes and rivers make this countryside not only very fertile but also a favored resort country. (5) In the extreme northwest corner of the state, a small area lies in the lake plain of Lake Erie (*ca.* 750 ft. above sea level). Here, somewhat sandy soil and abundant moisture provide good fruit-growing country; the major products are table and wine grapes. There is also a small but important mountainous area, the Pocono Mts., in the northeastern corner of the state. This region, known for a generally pleasant climate, many lakes, and striking waterfalls (*e.g.*, Dingman's Falls, Buck Hill Falls), is within easy distance from the New York and Philadelphia metropolitan areas and so enjoys great popularity as resort country.

Most of the rivers in the eastern part of the state flow into the Delaware; among these are the important Lehigh and Schuylkill rivers. Much of the central part of the state is drained by the Susquehanna River and its tributaries, one of the largest being the Juniata River, rising high in the mountains beyond Huntingdon. The western rivers of the state flow into the Mississippi system by way of the Monongahela and Allegheny rivers; these unite at Pittsburgh

to form the Ohio River, which flows north-westward from Pittsburgh to Beaver and then turns westward to cross the border near East Liverpool (Ohio). A small area in the south central part drains into the Potomac River, and in the northwest a few small streams flow into Lake Erie. The state has many mountain lakes, of which none are notably large.

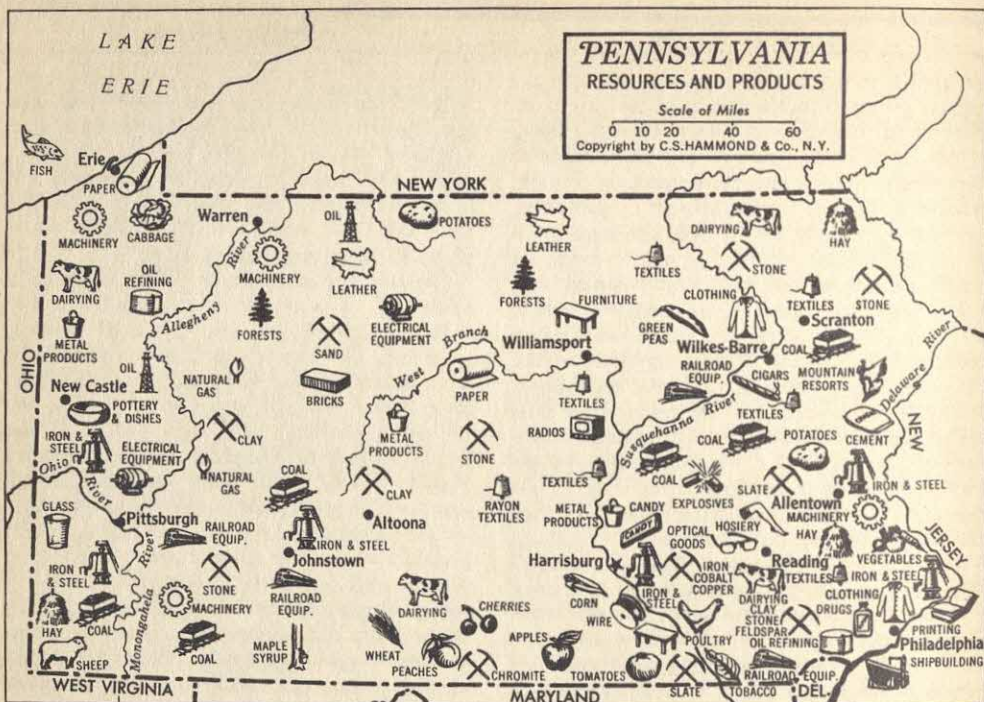
Climate: The southeastern corner of the state, along the Delaware River and east of a line drawn approximately from Easton to Reading, Lancaster, and Gettysburg, has a warmer and more equable climate than the rest of the state, being within range of winds from the Atlantic. To the north and west, the altitudes of the mountains and the Allegheny plateau, and winds from Lake Erie, create wider variations in temperature and precipitation. Summer temperatures in the mountains and on the northwestern plateau are usually comfortable, though the winters tend to be long and severe. Rainfall is evenly distributed over the state through most of the year. The southeastern corner rarely has heavy snows, but the mountains and the northwestern area, particularly near Lake Erie, normally get large amounts.

	Philadelphia	Pittsburgh
Normal temperature		
January	34.9° F.	33.0° F.
July	77.2° F.	75.4° F.
Annual mean	55.7° F.	53.9° F.
Latest frost	April 20	May 4
Earliest frost	Oct. 19	Oct. 10
Precipitation		
January	3.39 in.	2.83 in.
July	4.21 in.	3.72 in.
Annual	41.44 in.	36.23 in.
Average growing season	182 days	183 days

NATURAL RESOURCES

Pennsylvania has a wide variety of natural resources. The principal mineral products are coal, cement, stone, and natural gas; in 1961 the state ranked first in stone production and second in cement. It ranks second to West Virginia in coal tonnage, but first in the nation in value of coal, principally because of the higher value of anthracite. Most of the anthracite in the U.S. is produced in a small area in east central Pennsylvania, around Pottsville, Mahanoy City, Hazleton, Scranton, Ashland, Shenandoah, and Wilkes-Barre. Large deposits of bituminous coal occur widely throughout the state, but the principal mining and shipping centers are in the southwest, near Pittsburgh; some of the leading western coal towns are Johnstown, Connellsville, Irwin, and Monongahela. In 1961 the state produced 17,446,000 short tons of anthracite and 62,652,000 short tons of bituminous coal.

Cement rock is an important mineral resource. Cement ranks after coal in value of annual pro-



duction; Pennsylvania is second only to California, producing somewhat more than 11 per cent of all U.S. cement (in 1961, 36,635,000 bbl.). The first Portland cement made in the U.S. was made from Lehigh Valley limestone in 1871. Limestone suitable for cement occurs widely throughout the state.

Iron ore is mined at Cornwall, near Lebanon, and at the Grace mine at Morgantown, a few miles south of Reading. The mine at Cornwall, one of the nation's most important iron mines, has been operated continuously since 1742. Other minerals of value include clays, cobalt, lime,

and sand and gravel. Pennsylvania ranks 19th in oil production (in 1961, 5,622,000 bbl.). Production of natural gas in 1961 was 100,427,000,000 cu. ft.

Timber is also important. Because of the rugged terrain and the abundant rainfall, approximately one-half the total area of the state is forested. There are some 15,205,000 acres of commercial forests. The principal species are oak, sugar and red maple, cherry, and beech; there are also lesser quantities of yellow poplar, ash, white pine, pitch pine, and hemlock. Timber resources are estimated at 19,306,000,000 bd. ft. of sawtimber. The annual cut of sawtimber is ca. 428,000,000 bd. ft.

ANNUAL STATE EVENTS

Mummers' Parade and Welsh Eisteddfod	Jan. 1; Philadelphia
Pennsylvania Farm Show	Second week in January; Harrisburg
Annual Exhibit of Pennsylvania Acad. of Fine Arts	Last week in January; Philadelphia
Farm Show	January; Harrisburg
Boy Scouts' Annual Pilgrimage	Feb. 22; Valley Forge
Penn Relay Carnival	Last week in April; Philadelphia
Apple Blossom Festival	May 15-20; York
Bach Festival	Third week in May; Bethlehem
Memorial Day Celebration	May 30; Gettysburg
Flag Day Celebration	June 14; Betsy Ross House, Philadelphia
Historical Pageant and Fete	Second week in June; Old Swedes' Church, Philadelphia
Pennsylvania German Folklore Festival	July 1-4; Kutztown
Pocono Mt. Horse Show	July; Stroudsburg
Labor Day Pageant	First week in September; Harrisburg
Navy Day	Oct. 27; Philadelphia; open house at the Navy Yard
Sounding of the Liberty Bell	Dec. 31, midnight; Philadelphia

PENNSYLVANIA'S ECONOMY

At the time of the 1960 census, Pennsylvania had an employed population of 4,127,208. Of this total, ca. 36 per cent were in manufacturing; 5 per cent in construction; 3 per cent in agriculture, forestry, and fisheries; and 2 per cent in mining. The remainder were employed in the wholesale and retail trades, in government, and in supplying personal, professional, and other services.

The state is the leading U.S. center of iron and steel refining, and processed metals are its most valuable manufactured product. Other major industries, in the order of their 1960 manufacturing value, are the production of non-electrical machinery, food processing, and the production of electrical machinery and fabricated metal products. The state's value added by

manufacture was \$12,369,601 in 1961.

Throughout the state, soils are generally productive, and the southeastern area contains some of the richest farm land, acre for acre, in the U.S. There were 100,052 farms in 1960, occupying a total of 11,862,000 acres. The average farm had 119 acres, with land and buildings valued at \$21,892. Dairy products are the most important source of the state's farm income, yielding 40 per cent of all marketing receipts, while other livestock products—particularly poultry and eggs and meat animals—provide an additional 35 per cent. The most important crops are corn, wheat, potatoes, tobacco, truck vegetables, fruit, berries, and melons. Greenhouse and forest products (including maple syrup) are also a significant source of farm marketing receipts. The total cash income from crop and livestock sales amounted to \$793,347,000 in 1961.

Pennsylvania's mineral output was valued at \$791,648,000 in 1961, comprising 4.37 per cent of the total U.S. output and placing the state fourth among the states. The principal minerals, in order of their value, were coal, cement, stone, and natural gas.

The state is also a source of commercial furs; in 1958 this industry had a value added by manufacture of \$1,013,000.

TRANSPORTATION AND COMMUNICATION

The Delaware River is navigable for ocean-going vessels as far as Trenton (N.J.), ca. 20 m. above Philadelphia. The Port of Philadelphia has more than 250 piers and wharves, can accommodate at one time 150 ocean-going vessels, and averages some 250 regularly scheduled sailings per year. This port in 1959 ranked second in tonnage of foreign waterborne commerce among all U.S. Atlantic and Gulf coast ports. With the completion of the St. Lawrence Seaway, the already busy Great Lakes port of Erie began to develop as a port for overseas trade. The Ohio, Allegheny, and Monongahela rivers in western Pennsylvania are navigable for considerable distances by towboats and barges and provide water transportation for some 85 communities; the principal traffic is in coal.

The first railroads in the state were coal tramways, e.g., Thomas Lieper's Tramway at Chester (1809). The first steam railroad was built in 1829 by the Delaware & Hudson Canal Co. (now the Delaware & Hudson R.R.), which imported the famous "Stourbridge Lion" locomotive from England to operate it. The state is served today by 14 major railroads, including the Pennsylvania, the Baltimore & Ohio, the Erie-Lackawanna, the Lehigh Valley, and the New York Central R.R.'s and the Reading Ry. Total railroad mileage was 9,092 m. in 1960. In the same year the state had 109,261 m. of rural and municipal

roads, including 22,343 m. of unpaved rural roads. Most of the cities and towns have airfields, ranking the state third among all the states as to number of airports and airfields.

In 1961 there were a total of 206 radio stations and 20 television stations. Station KDKA, Pittsburgh, established in 1920, was the first permanent commercial broadcasting station in the world. The first newspaper published in the colony (and the second to appear in the middle colonies) was the *American Weekly Mercury* (Philadelphia, 1719). Another important early paper was the *Pennsylvania Gazette* (Philadelphia, 1728), which Benjamin Franklin purchased from its founder in 1729. Today's leading newspapers are the *Philadelphia Bulletin*, *Inquirer*, and *News*, and the *Pittsburgh Press*, *Post-Gazette*, and *Sun-Telegraph*. Also noteworthy is the *Pittsburgh Courier*, one of the major Negro newspapers in the world.

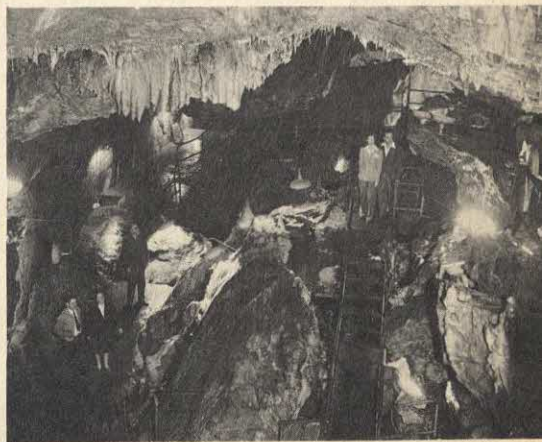
POPULATION

Pennsylvania has 67 counties. The 1960 census population was 11,319,366 (1962 est. population, 11,376,000). The urban population comprised 8,102,051, or 71.6 per cent; the rural population, 3,217,315, or 28.4 per cent. Between 1950 and 1960 the population of the state increased by 7.8 per cent. In 1960 almost 84 per cent of the urban—and almost 40 per cent of the total—population lived in the urbanized areas of Philadelphia, Pittsburgh, Allentown-Bethlehem, Wilkes-Barre, Scranton, Harrisburg, Erie, Reading, and York. In 1960 white persons numbered 10,454,004; of the 865,362 nonwhites the majority (852,570) were Negroes, and the remainder included Chinese, Japanese, Indians, Filipinos, and others. Pennsylv-

CRYSTAL CAVE, PENNSYLVANIA

This famous cavern, near Kutztown, is studded with crystals and other interesting formations

Courtesy Ewing Galloway, N. Y.



vania's native-born residents totaled 10,717,090; the foreign-born, 603,490. Population density in 1960 averaged 251.5 per sq. m.

The major religious bodies are Jewish congregations, the Lutheran Church in America, The Methodist Church, the Protestant Episcopal Church, the Roman Catholic Church, the United Church of Christ, and The United Presbyterian Church in the U.S.A.

Chief Cities: Philadelphia, in the southeastern corner of the state, is the largest city. It is noted for its historical importance and is a center for business, manufacturing enterprises, railroads, and shipping.

Pittsburgh, in the west, is the second-largest city, primarily a steel and iron center.

Erie, in the far northwestern corner of the state, on Lake Erie, is the third-largest city, and a major lake port.

Scranton, in the northeast, in the heart of the anthracite country, is the fourth-largest city.

Harrisburg, in the south central section, is the state capital and, with its industrial suburbs, a steel center.

The twin cities of Allentown and Bethlehem, at the eastern end of the state, merge so that they form, except for administration, virtually one unit; they are an important industrial center. Bethlehem is the home of the Bethlehem Steel Corp., Lehigh Univ., and much of the Pennsylvania German culture. Allentown is the seat of Muhlenberg and Cedar Crest colleges.

Famous Men and Women: Anderson, Marian (1908-), concert and operatic singer.

Aydelotte, Frank (1880-1956), Indiana-born educator, president of Swarthmore Coll. (1921-40), director of the Inst. of Advanced Study at Princeton (1939-47).

Bartram, John (1699-1777), botanist specializing in American flora, founder of the nation's first botanical garden (Philadelphia).

Buchanan, James (1791-1868), 15th President of the U.S. (1857-61).

Carnegie, Andrew (1835-1919), Scottish-born steelmaker and philanthropist, founder of Carnegie libraries and other institutions.

Dickinson, John (1732-1808), Maryland-born lawyer-statesman whose "Letters from a Farmer in Pennsylvania to the Inhabitants of the British Colonies" helped focus the popular movement toward the Revolutionary War.

Franklin, Benjamin (1706-90), Massachusetts-born statesman, publisher, leader in the Revolutionary War and the founding of the U.S.

Frick, Henry Clay (1849-1919), steelmaker and industrialist, cofounder of the U.S. Steel Corp.

Girard, Stephen (1750-1831), French-born financier and philanthropist, who endowed Girard Coll.

Graham, Martha (ca. 1898-), dancer and

choreographer, considered one of the outstanding leaders in the 20th-century dance movement.

McGuffey, William Holmes (1800-73), educator, author of McGuffey's "Eclectic Readers."

Morris, Robert (1734-1806), English-born financier, patriot, statesman, a signer of the Declaration of Independence, who had much to do with financing the Revolution and the new nation.

Mott, Lucretia (1793-1880), Massachusetts-born Quaker, abolitionist, pioneer fighter for women's rights, who was an organizer (1848) of the first convention on women's rights in the U.S.

Pinchot, Gifford (1865-1946), Connecticut-born public official, twice governor (1923-27, 1931-35) of Pennsylvania, a pioneer in forest conservation.

Pitcher, Molly (1754-1832), nickname of a New Jersey-born Revolutionary War heroine, Mary Ludwig Hays McCauley, who earned the sobriquet during the battle at Monmouth by caring for the wounded and heroically filling her husband's place at the cannon after he collapsed.

Rush, Benjamin (1745-1813), physician, sometimes called the "father of American medicine," a signer of the Declaration of Independence.

Salk, Jonas Edward (1914-), bacteriologist, who developed a vaccine against paralytic poliomyelitis.

Stevens, Thaddeus (1792-1868), Vermont-born statesman, lawyer; champion of the public-school system and of civil rights.

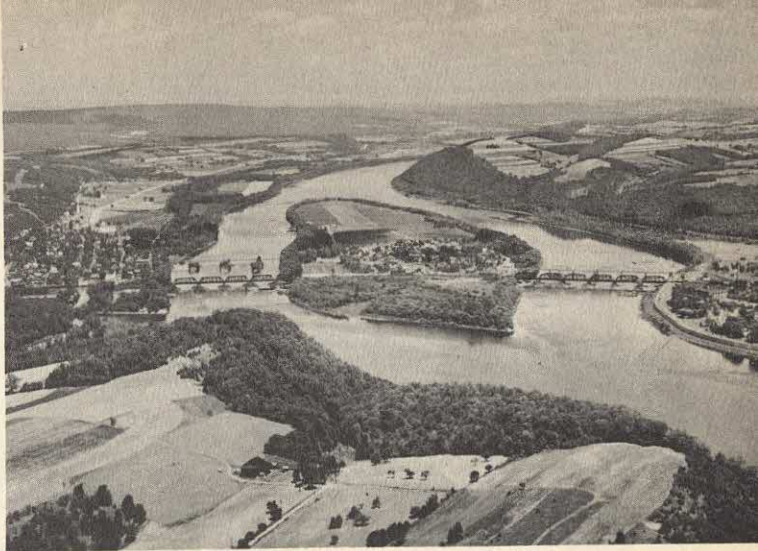
West, Benjamin (1738-1820), painter of portraits and historic and Biblical scenes; one of the first notable American painters, he was president of the British Royal Acad. (1792-1820).

EDUCATION

Education is free and compulsory for children between the ages of eight and 17. The public-school system was established by law in 1834. Subsequent legislation provided compulsory education (1849), established free education (1873), and provided for the establishment of high schools (1895). Enrollment in public schools in 1962 totaled 2,059,411, and there were 743,200 pupils in Roman Catholic parochial schools. The state has more than 70 colleges, universities, and specialized schools. The principal state-supported institutions of higher learning include the Pennsylvania State Univ., University Park; and 14 state colleges. Private and denominational institutions include Temple Univ. and Drexel Inst. of Technology, Philadelphia; the Univ. of Pittsburgh, Duquesne Univ., and Carnegie Inst. of Technology, Pittsburgh; Lafayette Coll., Easton; Bryn Mawr Coll., Bryn Mawr; Swarthmore Coll., Swarthmore; Haverford Coll., Haverford; Lehigh Univ., Bethlehem; Bucknell Univ., Lewisburg; Villanova Univ., Villanova; Dickinson Coll., Carlisle; and Franklin and Marshall Coll., Lancaster.

NORTHUMBERLAND BY AIR

This aerial view (*right*) shows Northumberland County, near the junction of the West Branch of the Susquehanna River and the main stream. This waterway drains lush farm lands and rich anthracite areas; many great industrial cities have grown along its banks. Improvements such as the construction of levees, flood walls, and reservoirs to control the river add greatly to the region's productivity (*courtesy Ewing Galloway, N.Y.*)

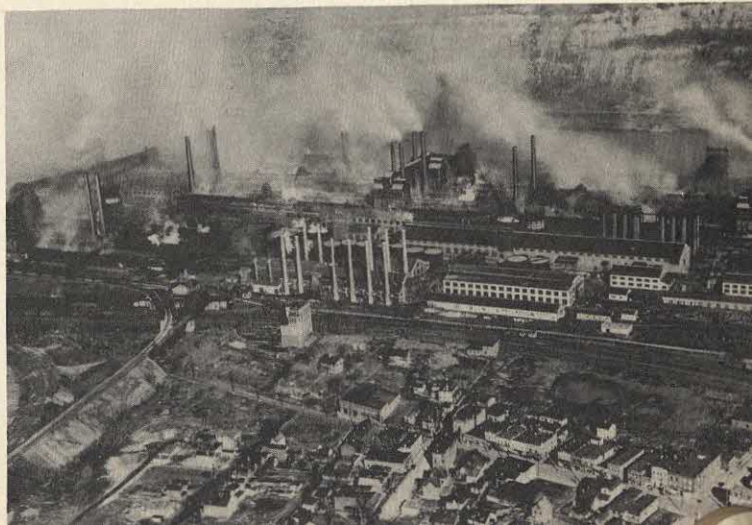


A RESOURCE PRESERVED

Soil-conservation programs, utilizing such methods as the contour strip cropping shown, help preserve the limestone topsoil which has made the Great Valley one of the country's most fertile regions. This area was developed by German immigrants who were labeled "Pennsylvania Dutch," and who established prosperous communities which still maintain their distinctive cultural heritage and traditions. As a whole, the agricultural output of the state places it among the top farming states of the East (*courtesy U.S. Soil Conservation Service*)

STEEL VALLEY

Pennsylvania's abundant coal deposits are the foundation of its giant steel industry. Ironmaking began in colonial days, with the area's water power and iron resources contributing to its success. Inventions gave an impetus to steel manufacture which helped to make Pennsylvania one of the nation's biggest and most valuable industrial states (*courtesy Pennsylvania State Dept. of Commerce*)



Among cultural institutions in Philadelphia are the Acad. of Natural Science; the Pennsylvania Acad. of the Fine Arts, founded 1805, the oldest art gallery and fine arts school in the U.S., with exhibits of art from 18th-century to contemporary works; the Philadelphia Museum of Art, with collections of paintings, sculpture, and decorative arts; and the Fels Planetarium. In Pittsburgh are the Carnegie Museum and Art Gallery; and the Buhl Planetarium and Inst. of Popular Science, with a natural science museum and adult classes in various sciences. Philadelphia, Harrisburg, and Pittsburgh support symphony orchestras, and annual music festivals are held in Philadelphia, Altoona, Bethlehem, Allentown, Lewisburg, and Wilkes-Barre.

GOVERNMENT

The first constitution was adopted in 1776, when the state was first organized. New constitutions were adopted in 1790, 1838, and 1873; the latter, extensively amended, is that under which the state is now governed. The constitution gives executive authority to a governor, lieutenant governor, secretary of internal affairs, auditor general, and treasurer, all elected for terms of four years. The governor, auditor, and treasurer cannot succeed themselves in office. The governor, with the consent of the senate, appoints a secretary of the commonwealth (state), an attorney general, a superintendent of public instruction, and several other cabinet officers,

each to serve for four years. The legislature, known as the general assembly, consists of a senate of 50 members, elected for four-year terms (one-half renewable every two years), and a house of representatives of 210 members, elected biennially. The legislature meets on the first Tuesday in January of odd-numbered years, for a normal session of five to six months. There is a supreme court of seven justices, elected for terms of 21 years (the longest in the U.S.) and ineligible for re-election. There are also a superior court (with statewide jurisdiction) of seven judges, elected for 10-year terms, and county courts, whose judges are also elected for 10-year terms. Other courts include courts of common pleas, magistrates' courts, orphans' courts, and peace courts, with locally elected justices. The state is represented in the U.S. Congress by two Senators and 27 Representatives.

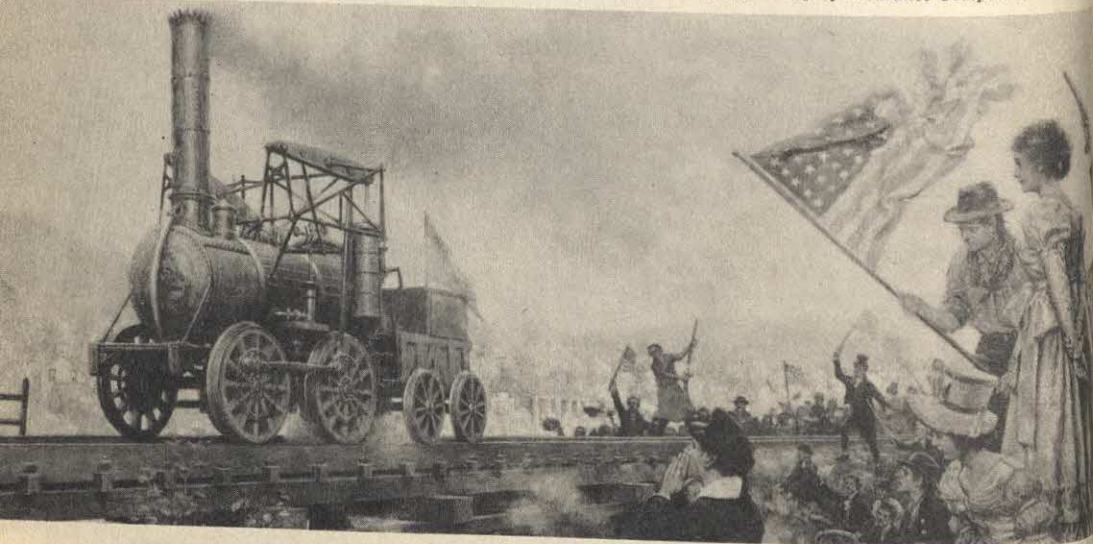
HISTORY

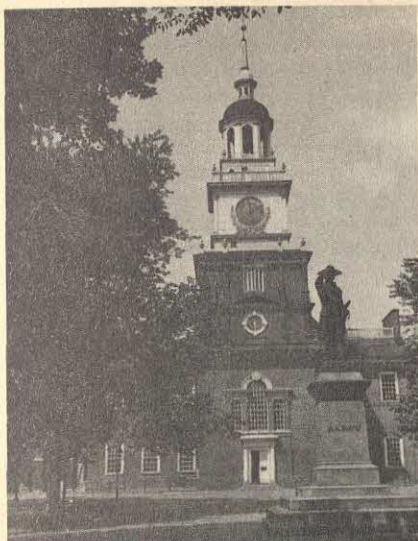
The post-Indian history of Pennsylvania began when Henry Hudson, a fur trader exploring for Holland, discovered Delaware Bay in 1609, establishing a Dutch claim to the valley of the "South River" (the "North River" was the Hudson). Swedish explorers followed and set up colonies in the 1630's. New Sweden fell to the Dutch in 1655, but an English force acting for the duke of York captured the Dutch possessions in America in 1664. Charles II of England, to discharge a debt owed to Adm. Sir William

THE STOURBRIDGE LION

The first steam locomotive to run on tracks in the U.S. was imported from England by the Delaware & Hudson Canal Co., and on Aug. 8, 1829, made a successful test run from the mines at Carbondale, Pa., to the canal terminus at Honesdale, Pa. The engine was soon discarded, however, because of its great weight

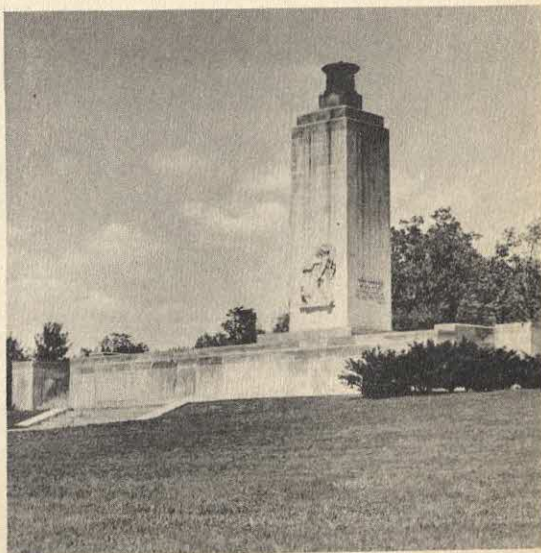
Courtesy America Fore Loyalty Group of Insurance Companies





REFLECTIONS OF U.S. HISTORY

Philadelphia's famous Liberty Bell rang out the signing of the Declaration of Independence at Independence Hall (above) in 1776 (courtesy Pennsylvania State Dept. of Commerce). In 1859 the discovery of oil near Titusville (above right) by Edwin L. Drake (in top hat) was a milestone in America's economy (courtesy Drake Well Museum). This blockhouse at Erie (right) was built to honor Gen. Anthony Wayne, who won peace with the Indians of the Northwest Territory (courtesy Ewing Galloway, N.Y.). The Eternal Light Peace Memorial at Gettysburg (bottom right) represents today's good will between North and South. Reading's pagoda (below) is a symbol of the many nationalities which contribute to the state's diversity and rich cultural heritage (courtesy Ewing Galloway, N.Y.).



Penn, granted proprietary and governmental rights over the region (March 4, 1681) to the admiral's son, William Penn, and in the charter gave it the name "Pensilvania." Penn, a libertarian Quaker, conceived his colony as a "Holy Experiment," where settlers of all nationalities and faiths could enjoy the political freedom, religious liberty, and economic opportunity denied them in their homelands. He came over to America himself (1682-84) to get it organized. The bulk of the earliest settlers were English Quakers, who settled in the southeastern counties and set a dominant tone for the economic and cultural life of the colony. After about 1727, many Germans settled in the interior counties; by 1776 they numbered *ca.* 100,000, about one-third of the population. Another major group was that of the Scotch-Irish, who came in increasing numbers after *ca.* 1728 and were an important factor by the time of the Revolutionary War. These people were the frontiersmen, who moved on across the mountains into central and western Pennsylvania. Other groups included Welsh, French Huguenots, Irish, Dutch, and Swedes. (The later influx of Italians, Croats, and other southeastern Europeans, so visible in the state's present population, did not arrive until the late 19th-century expansion of the iron and steel industries.) By 1776, the drawing power of liberty and opportunity had made Pennsylvania the third-largest colony, with a

population of *ca.* 300,000, despite the fact that it was the 12th of the 13 colonies to be founded.

Pennsylvania's economy rested upon diversified farming, livestock raising, iron manufacture, lumber, shipbuilding, tanning, and home production of textiles. The Quaker temperament and the original wisdom of William Penn kept Indian troubles notably lower than in some of the other colonies. The Conestoga wagon and the "Kentucky" rifle, both of Pennsylvania origin, aided in the expansion and settlement of the interior. Philadelphia early became a commercial metropolis and an important center of foreign trade. Major boundary disputes arose with Maryland on the south and with Connecticut on the north because of vagueness in the original charters. The running of Mason and Dixon's Line in 1763 and 1767 fixed the southern boundary, and the Trenton Decree of 1782 awarded the disputed northern corridor to Pennsylvania.

Philadelphia was the home of the Continental Congress in 1774-75, and it became the birthplace of the Declaration of Independence (July 4, 1776). Major engagements of the Revolutionary War were fought in Pennsylvania at Brandywine, Germantown, and White Marsh; Philadelphia was occupied by the British during the winter of 1777-78, while Washington's troops resisted the rigors of winter, with scanty supplies, at nearby Valley Forge.

MAJOR RECREATIONAL AND HISTORIC FEATURES

Name and Type	Size and Location	Points of Interest
Pt. Necessity National Battlefield Site (established 1931)	2 acres (plus 311-acre state park of same name), in the southwest, 12 m. S.E. of Uniontown (U.S. 40)	Site of the battle of Great Meadows (1754), opening battle of the French and Indian War; museum
Gettysburg National Military Park (established 1895)	3,409 acres, in southern Pennsylvania, 1 m. S. of Gettysburg (U.S. 15)	Site of the battle that marked the turning point of Confederate strength in the Civil War; national cemetery dedicated by President Lincoln in his Gettysburg Address (1863)
Hopewell Village National Historic Site (established 1938)	848 acres within French Creek State Park (state 82, 83)	Notable example of the American 18th- and early 19th-century iron-making village; village restored and furnace in operation
Independence National Historic Park (established 1956)	21 acres, mostly in downtown Philadelphia	Buildings and areas associated with the Revolutionary War and the founding of the nation: Independence Hall, Congress Hall, Independence Square, Old City Hall, and the Deshler-Morris House at Germantown
Allegheny National Forest (established 1923)	712,977 acres, in the northwest, near Warren (U.S. 6, 62; state 59)	Allegheny Mts.; Chief Cornplanter Indian Reservation; natural areas; waterfowl refuge; Watermill Race ski trail; 300 m. of trout streams
Caledonia State Park (established 1902)	1,444 acres, in south central Pennsylvania, 15 m. N.W. of Gettysburg (U.S. 30)	Named for charcoal-iron furnace established by Thaddeus Stevens (1837) and destroyed by Gen. Jubal Early's Confederate forces (1863)
Cook Forest State Park (established 1927)	7,822 acres, in the northwest, along the Clarion River (state 36, 66, 157)	Contains the state's largest stand of virgin timber, the remnant of primeval "Penn's Woods"
French Creek State Park (established 1945)	6,022 acres, in the southeast, 15 m. S.E. of Reading (state 82, 83)	Hopewell Village; 62-acre recreational lake
Raccoon Creek State Park (established 1949)	7,159 acres, in the west, <i>ca.</i> 40 m. W. of Pittsburgh (U.S. 30)	Forest preserve of wooded hills, with a 101-acre lake, on the site of an area formerly denuded by strip mining
Valley Forge State Park (established 1893)	2,033 acres, in the southeast, <i>ca.</i> 6 m. W. of Norristown (U.S. 202; state 23)	Memorial to George Washington who, with his Continental Army, spent the winter of 1777-78 here; Washington's headquarters preserved
Hawk Mt. Bird Sanctuary (state, established 1934)	On Hawk Mt. (part of Blue Mt.) in east central Pennsylvania, <i>ca.</i> 8 m. N. of Hamburg (U.S. 122; state 895)	One of the world's few refuges for predatory birds; at certain seasons, hawks may be seen by hundreds
Pocono Mts.	Large area in northeastern Pennsylvania; key towns, Stroudsburg (U.S. 209) and Mt. Pocono (U.S. 611)	Mountains, lakes, streams; fishing, swimming; hotels, camps; year-round resort country

The Commonwealth adopted the first of its four constitutions in 1776. The new national government of the U.S. was created by the Constitutional Convention that met in Philadelphia in 1787, and Pennsylvania was the second state to ratify the Constitution. Philadelphia was the national capital until 1801, and one of the earliest demonstrations of Federal authority was the suppression of the Whisky Insurrection (1794) in western Pennsylvania.

After 1750 Pennsylvania became the leader of the iron industry, a position it never relinquished and which was of vast importance in its economic growth. Industrialism, the factory system, exploitation of natural resources, improved communication systems, continued immigration, and the concentration of a rapidly increasing population were significant trends during the 19th century. Pennsylvania led the nation in turnpike construction, with some 3,000 m. of improved highways in use in 1832, supplemented by a network of canals, until the coming of the steam locomotive in the 1830's; by 1860, nearly 2,600 m. of railroads were in operation. Anthracite coal was first mined in quantity in 1839. Bituminous coal and rich deposits of iron ore enabled the state to assume leadership in heavy industries after the Civil War. The oil industry began in Pennsylvania, where the world's first well was drilled at Titusville in 1859. For a time in the 19th century, the state produced virtually all the nation's petroleum. The need for labor organization had produced, as early as 1827, the Mechanics Union of Trade Associations in Philadelphia. The coal, iron, and railroad industries, resisting unionism, experienced bitter labor strife; the most prominent instances were the Molly Maguire movement of the 1870's, the Homestead Strike of 1892, and the anthracite strike of 1902.

In both World Wars the value of Pennsylvania's coal, steel, and shipbuilding industries was of enormous importance. In the Civil War, Pennsylvania contributed 362,284 men to the Union Army and more than 14,000 to the Navy. In World War I, 359,754 residents served in the armed forces; and in World War II, 1,297,522 men and women from Pennsylvania saw military service.

In the postwar years, the state has embarked on a statewide public and private drive to develop and attract new industry. With a large number of universities and colleges, Pennsylvania has endeavored to gear its educational system toward providing the needs of the state's expansion. Its major cities have engaged in long-term programs of urban renewal to remove blighted areas and provide increased opportunity for their citizens.

See also separate entries on most of the in-

dividuals and geographical and historical subjects mentioned in this article.

Pennsylvania Dutch, a name commonly applied to the descendants of the German and Swiss who began settling in eastern Pennsylvania in the middle of the 18th century and to the German dialect they spoke (which was not Dutch at all but was so called from the German word *Deutsch*, meaning "German"). The original settlers, however, were a group of Mennonites who founded Germantown (q.v.) in 1683. They were followed by other religious sects—the Dunkards, Moravians, and Schwenkfelders (see *Dunkards*; *Moravian Brethren*)—who settled in the southeastern Pennsylvania counties of Berks, Lancaster, Lebanon, Lehigh, Northampton, and York. By the time of the American Revolution, German-born persons made up approximately one-third of the population of Pennsylvania.

The majority of the immigrants became farmers and settled in large colonies, maintaining their own language and customs (still largely preserved by the Amish people) and generally opposed to any signs of worldly living. Their language gradually incorporated many English words and became an admixture of their Palatinate High German dialect and English. Considerable literature has been produced in this tongue, including many religious works; and the modern dialect appears in such books as "D is for Dutch" (1934) by Thames R. Williamson and "A High Wind Rising" (1942) by Elsie Singmaster.

The Pennsylvania Dutch developed a specific type of folk art in the U.S. Dating mostly from the 18th and early 19th centuries, it shows at its best in carpentry, furniture, ceramics, glassware, and needle arts. The basic shapes are sturdy, the motifs simple, but the over-all design and ornamentation are vivid and gay in color, expressing a peasantlike feeling. A noteworthy special field is illuminated manuscripts—personal documents such as birth, baptismal, or marriage certificates—called "fraktur," executed in decorative calligraphy which is highly ornamental in appearance. See also *Chinaware*.

Pennsylvania Railroad Company, THE, a Pennsylvania corporation and the parent company of a number of railroad and ferry corporations which together comprise the Pennsylvania R.R. system (nicknamed the "Pennsy"). On April 13, 1846, the Pennsylvania Railroad Co. was incorporated and authorized to build a railroad connecting Pittsburgh (or any other town in Allegheny County) or Erie, with Harrisburg, which was on the Harrisburg, Portsmouth, Mount Joy, and Lancaster R.R. Three years later, the first line opened from Harrisburg to Lewiston, a distance of 6 m., and

in 1854 there was service between Philadelphia and Pittsburgh. Starting in 1857, the company bought a number of railroad lines operated by the state; in Pennsylvania, the company directly owns the principal lines of the system and operates 95 per cent of the mileage. Under presidents John E. Thomas (1852-74), Thomas A. Scott (1874-80), George B. Roberts (1880-97), and Alexander J. Cassatt (1899-1906), the company expanded its system from the Atlantic Seaboard to the Mississippi River and from the Great Lakes to the Ohio River; and today the Pennsylvania maintains a network of more than 10,000 m.

Freight carried by the railroad is chiefly iron, steel, coal, and other raw materials, and general produce, packing-house products, and lumber from the South and West. Because it services the four big ports on the East Coast—New York, Philadelphia, Baltimore, and Norfolk—it also handles extensive import-export trade.

Pennsylvania State University, THE, a co-educational state institution of higher learning at University Park, Pa., chartered in 1855. It comprises nine undergraduate colleges—agriculture, business administration, chemistry and physics, education, engineering and architecture, home economics, liberal arts, mineral industries, and physical education and athletics; a counseling division; and the Graduate School. There are also 15 Commonwealth Campuses, located at various cities in Pennsylvania. The library contains nearly 600,000 volumes. Annual student enrollment totals ca. 20,000, and there are some 2,000 faculty members. The physical plant is valued at \$103,000,000.

Pennsylvania Turnpike, a 360-m. motor highway across southern Pennsylvania, with a 110-m. branch from Philadelphia to Scranton. It connects with the New Jersey Turnpike near Philadelphia and with the Ohio Turnpike near Youngstown, thus serving as a link in a super-highway network running from Boston to Chicago. It has wide traffic lanes, two in each direction, separated by a divider strip, and no stop lights or crossings. It may be entered or left only by cloverleaf intersections at intervals of ca. 20 m. Easy grades and, on the main road, seven tunnels through higher mountains, cut cross-state driving time substantially. The first stretch, 160 m. from Harrisburg to Pittsburgh, begun in 1938 and opened to traffic in 1940, advanced the modern development of high-speed, limited-access toll highways.

Pennsylvania, UNIVERSITY OF, a privately supported institution of higher learning at West Philadelphia, Pa., founded in 1740 and adopting its present name in 1791. It comprises the colleges of arts and sciences, general studies, and liberal arts for women; the Wharton School of

Finance and Commerce; the Moore School of Electrical Engineering; the graduate school of fine arts; schools of nursing, chemical engineering, civil engineering, mechanical engineering, metallurgical engineering, allied medical professions, education, social work, medicine, law, dentistry, and veterinary medicine; the graduate school of medicine, graduate school of arts and sciences, evening school of accounts and finance, Wharton graduate division, and summer school. There are many auxiliary divisions, of which the best known are the University Museum and the Morris Arboretum.

The annual student enrollment totals ca. 17,000, and there are ca. 3,200 members of the faculty. The library has 1,570,000 volumes. The physical plant is valued at more than \$76,750,000.

Penny (*pēn'ī*), a coin current in England, representing in value the 12th part of a shilling. The name was derived from the Anglo-Saxon word *penig*, which corresponds to the German word *pfennig*. The first English penny, a silver coin weighing 22½ grains, was struck in 735 by King Offa of Mercia, who modeled it on a French coin known as *novus denarius*. With few exceptions, the penny remained the only coin current in England until Edward III's gold florin of 1343. In 1257 Henry III struck a gold penny equal to 20 silver pence. From 1300 onward, the weight and value of the silver penny steadily declined. Since 1662, silver pennies have been issued only as alms on Maundy Thursday (Thursday of Holy Week), and are known as maundy money. George III in 1797 struck copper pennies weighing 1 oz. In 1860 the first bronze penny was introduced, containing one part of zinc, four parts of tin, and 95 parts of copper. The abbreviation is *d.*, derived from the coin *denarius*.

In the U.S., the word *penny* is applied colloquially to the American cent, equal to 1/100th part of a dollar. See also *Coin*.

Pennypacker (*pēn'ī-pāk-ēr*), GALUSHA, soldier, born in Schuylkill County, Pennsylvania, June 1, 1844; died in Philadelphia, Oct. 1, 1916. In 1861 he enlisted in the Federal Army as quartermaster sergeant and then became a captain in the 97th Pennsylvania Infantry. He was made a colonel in the Union Army in 1864, soon became a brigadier general of volunteers, and major general of the U.S. Army in 1865. During the Civil War he participated in the battles of Drewry's Bluff, Cold Harbor, and Petersburg. In the assault (Jan. 15, 1865) on Ft. Fisher, he was seriously wounded leading a brigade and, in 1891, received the Congressional Medal of Honor for his bravery. He commanded the 16th Infantry from 1869 until his retirement in 1883.

Pennyroyal (*pēn-ȳ-rōy'al*), a species of mint,

widely distributed in England and Ireland and native to Europe and Western Asia. In North America a small plant, *Hedeoma pulegioides*, is called pennyroyal.

Penobscot (*pě-nôb'skôit*), an American Indian tribe of Algonquian stock, which dwelt around the Penobscot River (*q.v.*) and Bay in central Maine. They sided with the French in the colonial wars, but made friends of the English in 1749. In the American Revolution, they supported the colonists. They now own a number of islands above the Indian Island at Old Town, Me., their principal settlement. They send a delegate to the state legislature, and engage in hunting, fishing, basketry, and guiding of sportsmen. Most of them have intermarried with whites. In 1940, they numbered about 600.

Penobscot, a river and bay in Maine. The river is the largest in the state. It rises by the West Branch in a small lake near the border of Quebec, flows southeast into Penobscot County, where it joins the East Branch, or Seboois River, and thence flows toward the south into Penobscot Bay. The river furnishes an abundance of water power. It flows through a productive lumbering region, is 300 m. long, and is navigable for ships to Bangor. Penobscot Bay is an inlet from the Atlantic Ocean. It is about 30 m. long and 20 m. wide at its entrance, and contains a number of islands. Both the bay and river furnish excellent facilities for navigation and contain valuable fisheries. Among the chief towns on the Penobscot are Bangor, Belfast, Hampden, Old Town, Lincoln, and Medway.

Penology (*pě-nôl'ô-jī*), from the Latin word *poena* (punishment), the branch of criminology dealing with prison organization and the punishment and reform of criminals. Modern penology, which emphasizes the possibility of reforming the criminal rather than punishing him, was spurred by the efforts of John Howard, an Englishman, who in 1773 testified before the House of Commons on the poor organization and bad conditions in the prisons of Great Britain. As the result of his effort, legislation was passed (1774) improving sanitation and doing away with jailers' fees in British prisons. The effect of Howard's work spread to other countries, and he was followed by many other prison reformers. U.S. prisons use the honor system, under which men whose behavior is good (known as trustees) are considered worthy of trust and are given special privileges, as a reformatory technique. See also *Crime*; *Convict Labor*; *Corporal Punishment*; *Juvenile Delinquency*; *Pardon*; *Prisons*.

Pensacola (*pě-n-să-kô'lă*), a city, county seat of Escambia County, Fla., on Pensacola Bay, an inlet of the Gulf of Mexico. It is on the St. Louis & San Francisco and the Louisville & Nashville R.R.'s. It is a port of entry, has an excellent

harbor, and near it are Fts. Pickens, MacRae, and San Carlos (started in 1559). The city has an extensive trade in lumber, cotton and woolen goods, coal, hides, tallow, fish, and naval stores. Noteworthy buildings include the state armory, the courthouse, the Pensacola Hospital, and the U.S. government buildings. It has manufactures of chemicals, lumber, canned fish, machinery, paper goods, furniture, and adhesives. Near the city is the largest naval aviation training school of the world. Pensacola was founded by the Spaniards in the early part of the 18th century. General Jackson captured it in 1814, and five years later it became a permanent possession of the U.S. by virtue of the Florida Purchase. A fire destroyed much of the city in 1864, but it was soon rebuilt. Population, 1900, 17,747; in 1950, 43,479.

Pension (*pěn'shūn*), an allowance of money paid to a person who previously rendered services, or to the widow and children of a deceased person. Pensions are paid as periodical allowances or rewards for service rendered in a civil or military capacity. In a number of countries, they are granted to persons who have served the government for a specified length of time.

In the U.S., a monetary allowance payable to a person on account of long military or civil service is called "retirement pay" rather than pension. This benefit is also awarded on account of permanent injury or disability received in line of duty.

An allowance to a civilian employee (usually paid for a temporary period) for injury or disease incurred in line of duty is called "compensation" rather than pension.

Prior to World War I, benefits payable to former members of the armed forces (other than retirement pay) were termed pensions whether awarded (a) for disability or death incurred in or aggravated by service, (b) for disability or death not the result of service, or (c) for age, plus, as to (b) and (c), a minimum period of service.

A distinction was made for World War I veterans, whereby an allowance based on service-connected disability or death was termed "compensation" and an allowance based on nonservice-connected disability or death was termed "pension." Since July 1946, this distinction, by statutory enactment, has been applied to allowance based on military service (except retirement pay) regardless of when rendered, including World War II and the Korean conflict.

The origin of legislation granting monetary benefits to former members of the armed forces is a resolution adopted by the Continental Congress, Aug. 26, 1776, promising pensions to soldiers and seamen who might be disabled in the Revolutionary War. The first actual law was that of 1789, which placed upon the Federal government the obligation of paying war pensions

granted by the states. In 1828 an act was passed granting all survivors of the Revolutionary War service pensions. In 1862 existing legislation was written into the General Pension Law which, with amendments, is still in effect. The first service pension law for veterans of the Civil War was enacted in 1890.

Congressional enactments have provided compensation for veterans (and their dependents) of all succeeding wars in which the U.S. has been involved and of peacetime service for service-connected disability or death. Pensions have been provided to war veterans and their dependents based on nonservice-connected disability, or age, or death.

A World War I, World War II, or Korean conflict veteran who served for at least 90 days, and whose discharge was under other than dishonorable conditions, receives \$66.15 a month if he is permanently and totally disabled. This is increased to \$78.75 a month after 10 years or when he becomes 65 years old. Pensions are payable to the widows and children of these veterans, the usual rate being \$50.40 for widows, with additional amounts payable when there are children. Service pensions are not payable for peacetime service.

The majority of veterans of wars preceding World War I, and their dependents, receive service pensions rather than disability or death compensation. For veterans of the two World Wars and the Korean conflict, monthly compensation rates range from \$17 to \$81, depending upon the degree of disability. Where certain specific disabilities, or certain combinations of disabilities exist, the amounts payable are larger and may be as high as \$420 a month. If the veteran is not less than 50 per cent disabled and has dependents, he is entitled to additional compensation. Disability compensation for peacetime service is payable at 80 per cent of the corresponding rate for wartime service. Compensation for service-connected death prior to Jan. 1, 1957 (wartime and Korean conflict veterans) is payable at the rate of \$87 a month to the widow, plus additional amounts for children, and \$75 for one dependent parent or \$80 for both. On Jan. 1, 1957, the Servicemen's and Veterans' Survivors Benefits Act inaugurated a revised death compensation program, under which monthly payments to widows are partially related to the military pay of their deceased husbands. Existing uniform payments for children were slightly increased; and provision was made for a sliding scale of benefits for dependent parents.

In lieu of pension or compensation, reserve officers called to active duty in the armed forces may be eligible for the same disability retirement provisions that apply to personnel of the regular services. These officers are protected if disabled

while in training in an inactive reserve status, as well as when on active duty.

Pension and compensation money due individuals from the government cannot be taken by garnishment or attachment. In some states the money received as pensions and invested in securities or property of any kind cannot be taken by a court process in payment of debts without the consent of the pensioner.

By an act of 1833, a Pension Office was established in the War Dept., to administer the veterans' pension program; in 1849 this became a bureau of the U.S. Dept. of the Interior. In 1930 it was transferred to the Veterans Admin.

Before the outbreak of World War II, the highest number of active pension cases on record was reached during the year ending June 30, 1933, when 997,918 living veterans were on the rolls, in addition to 272,749 claimants for deceased veterans' allowances. The pensions paid to these cases totaled \$550,559,342 in 1933.

As of Dec. 31, 1956, there were 3,608,894 living and deceased veterans on account of whom pension, compensation, or retirement pay was being paid by the Veterans Admin., an increase of 131,805 over the 3,477,089 on the rolls on June 30, 1955. As of Dec. 31, 1956, the number of deceased veterans on whose behalf death compensation or pension was being paid was 844,162. A total of \$2,748,989,286 was expended by the Veterans Admin. for compensation, pension, and retirement pay during the fiscal year ending June 30, 1956, an increase of \$114,696,749 over the total amount expended in 1955.

In addition to pension plans for veterans and government workers, pension plans for workers in private industry have recently increased in frequency. In 1956, *ca.* 13,500,000 employees (including supervisors and executive employees) were covered by pension plans, compared with 5,500,000 in 1945. About three-fourths of these pensions are financed on a noncontributory basis, that is, solely by employers. The remainder require contributions by workers and employers. Pension plans are either funded or unfunded. In a funded plan (the more common type), pensions are not dependent upon the future financial earnings of the company; such a plan provides for the accumulation of money for the future payment of pensions. In an unfunded plan, pensions are dependent upon the employer's future earnings and his future attitude because he puts no money aside into a special pension fund. Under most negotiated plans, it has been estimated, a worker employed for 30 years at annual earnings of \$4,200 will receive a retirement income of between \$170 and \$200 a month, including Social Security benefits of \$108.50. See also *Rehabilitation; Social Security; Veterans Administration.*

PENTAGON

Pentagon (*pěn'tà-gŏn*), a five-sided figure. See *Polygon*.

Pentagon Building (*pěn'tà-gŏn bîld'ing*), THE, a building occupied by the U.S. Dept. of Defense, situated across the Potomac River from Washington, D.C., and the world's largest office building—in floor space, about three times the size of the Empire State Bldg. (*q.v.*). Its construction was completed Jan. 15, 1943. Each of its five sides is nearly a half-mile long. In form, it comprises five concentric pentagons, connected by corridors radiating from a central pentagonal corridor. Although it is only five stories high, the building covers 34 acres. Its gross area is 6,543,750 sq. ft. It accommodates 32,000 workers and cost approximately \$75,000,000.

There are 17½ m. of corridors. It has the largest branch telephone exchange in the world. Every day the inter-office calls average 225,000 and operators handle 90,000 outside calls. Paved parking areas around the building cover 46 acres. Daily, 60,000 servings of food are dispensed in six cafeterias. The Public Buildings Administration, which operates the building, has a regular maintenance staff of about 1,200. At the three-lane bus and taxi terminal beneath a concourse 680 ft. long and 150 ft. wide, 28 buses can load at the same time and 25,000 passengers can be handled in one hour.

The outside perimeter is faced with limestone; all other walls are of monolithic concrete. Construction, including 30 m. of highways, was rushed through in 16 months.

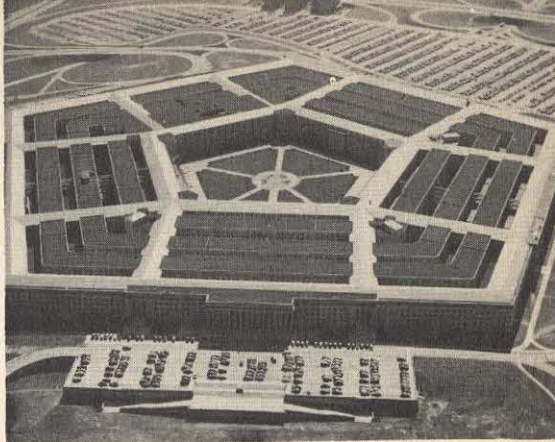
Among other features are a library of more than 200,000 volumes; a dispensary with physicians, dentists, and nursing staff, that treats about 260 patients daily; banking accommodations; and auditoriums for lectures, musical events, religious services, etc., and a variety of shops, including a department store.

The Pentagon houses the Secretary of Defense, the Secretaries of the Army, Navy, and Air Force, their staffs, the military heads of the three Armed Services and their staffs, and the heads of Boards and Agencies of the armed forces of the nation.

See also *National Military Establishment*; *United States*: DEPARTMENTS OF.

Pentagram (*pěn'tà-grām*), also known as PENTACLE or PENTALPHA, a five-pointed star formed by five interlacing straight lines. The Pythagorean School, founded in Greece by Pythagoras during the 6th century B.C., used the pentagram as a symbol of recognition and referred to it as health. During the Middle Ages magicians and astrologers gave it various mystical meanings. The pentagram is a member of a series of star-polygons, which includes the triangle and the hexagram.

Pentameter (*pěn-tăm'ē-tēr*), a term used in prosody to refer to a verse line of five feet.



U. S. Air Force Photo

AIR VIEW OF THE PENTAGON BUILDING

Originally the term applied to elegiac verse alone, in which the second of each pair of lines had five feet (dactylic and spondaic) arranged in an exact pattern. The word "pentameter" is now applied to any verse in which there are five feet to a line.

In English, pentameter verse is usually iambic. That is to say, the line is made up of five units, called "feet," each of which includes an unstressed and a stressed syllable. The term is most commonly applied in English poetry to "heroic couplets" or to "blank verse," but it may be applied to any verse of five feet. Heroic couplets are pairs of end-stopped, five-foot iambic rhymed lines. Blank verse has unrhymed five-foot iambic lines.

The following heroic couplet by Alexander Pope (*q.v.*) is in iambic pentameter verse:

True wit is Nature to advantage dress'd,
What oft was thought, but ne'er so well express'd.

Pentateuch (*pěn'tà-tūk*), a term applied to the first five books of the Old Testament when spoken of collectively, *i.e.*, Genesis, Exodus, Leviticus, Numbers, and Deuteronomy. The Jews call them by the Hebrew name *Torah*, meaning the Law. Josephus was the first to mention the fivefold division. Many writers group these books with the Books of Joshua under the term *Hexateuch*, since they form a continuous line of writing.

Pentecost (*pěn'tē-kōst*), one of the three principal festivals of the Jews, held on the 15th day after the 16th Nisan, the second day of the Passover. It is celebrated as a thanksgiving for the ingathering of the harvest. Formerly two loaves of leavened bread made from new grain, called the *first fruits*, were offered and the poor were remembered by liberal gifts. At present the Jews celebrate Pentecost two consecutive days and the name *Feast of Weeks* is used to some extent, since it follows the Passover after seven weeks. The Christians celebrate Pentecost in commemoration of the descent of the Holy Ghost on the disciples, occurring 50 days after Easter. The

names Whit-Sunday and Whitsuntide are used to designate this day in England, from the circumstance that white garments were formerly worn by those upon whom baptism was conferred.

Penthesilea (pĕn-thē-sī-lē'ā), in Greek mythology, the beautiful daughter of Ares (q.v.). She was a queen of the Amazons and, after the death of Hector, aided the Trojans. She was finally slain by Achilles.

Pentothal Sodium (pĕn'tō-thāl sō'dī-ŭm), sodium ethyl (1-methylbutyl) thiobarbiturate, a water-soluble, quick-acting synthetic barbituric acid derivative used intravenously to produce general anesthesia for selected surgical operations of brief duration such as changing painful dressings, removing sutures, setting fractures, suturing accidental wounds, etc. It is sometimes used to produce rapid anesthesia prior to inhalation anesthesia for prolonged procedures.

Penumbra (pĕ-nŭm'brā), in astronomy, an incomplete or partial shadow. In an eclipse, where the light is partly cut off by the intervening body, the shadow cast is called the penumbra. It occurs in a partial eclipse between the *umbra*, or *perfect shadow*, on all sides, and the full light. At the time of a total eclipse of the sun the observer is in the *umbra*. See *Eclipse*.

Peonage (pĕ'ōn-āj), a term variously applied to different countries, but usually to describe a system of servitude in Spanish-American countries. The *peon* of Mexico was in early colonial times placed under bondage to serve his creditor until the debt was paid and, by reason of limited wages and a system of loaning money to the peons, it often became necessary for several generations to labor before the obligations could be complied with. A law of Congress, in 1867, abolished peonage in New Mexico, where it had been introduced from Mexico, and it has since been abolished in some of the countries of South America, though in others it still remains as a system not unlike perpetual servitude.

Peony (pĕ'ō-nŷ), a genus of plants of the crowfoot family. They are cultivated extensively in gardens and for ornamental purposes. The species include a half shrubby plant native to Eastern Asia and Japan, where it attains a height of about 12 ft., and bears beautiful whitish flowers with pink markings. Other species are of the herb order, having deeply lobed leaves and perennial tuberous roots. The *Siberian peony* bears a double white flower, the peony native to Switzerland has double crimson or white flowers, and the Russian peony is fern-leaved; all these belong to the herbs. Emetic and cathartic properties are found in the seeds and roots. Formerly the common peony was held in repute for its medical properties, though at present it is not so regarded.

People's Party (pĕ'p'lz pār'tŷ), a political organization formed in the state of New York in 1824 by a wing of the Democratic party, which favored choosing the electors by a direct vote of the people. They supported William H. Crawford for President, who received 41 votes in the electoral college. In 1891 the farmers' alliances, the labor and granger organizations, and the Greenback party organized the People's party that was prominent in the election of 1892 and several subsequent elections. Afterward it became generally known as the *Populist* party. James B. Weaver, of Iowa, was the nominee for President in 1892, receiving 1,030,128 popular votes and 23 votes in the electoral college. In 1896 and 1900 the party supported William J. Bryan, the nominee of the Democratic party, for President. Among the principal issues advocated by the People's party were included the abolition of national banks, the issuance of money direct by the government, the payment of all government obligations in any kind of lawful money, the establishment of postal savings banks, bimetallism, an income tax, the election of U.S. senators by direct vote of the people, and opposition to all forms of monopoly harmful to industrial and commercial enterprises.

Peoria (pĕ'ō-ri-ā), a city and port of entry in central Illinois, seat of Peoria County, on Lake Peoria (a branch of the Illinois River), 157 m. s.w. of Chicago. It is the terminal point for 13 railroads, of which the Chicago, Rock Island and Pacific provides passenger service. Peoria Airport is ca. 5 m. w. of the city. Covering an area of 15.2 sq. m., Peoria devotes 2,012 acres to a system of six parks.

An industrial and distribution center, Peoria is in the heart of a rich grain- and livestock-producing area. The Board of Trade is one of the large primary grain markets, and the stockyards represent one of the world's largest truck-in markets. Peoria's manufactures include beverages, agricultural implements, building materials, chemicals, and appliances. The city is the center of the Peoria standard metropolitan statistical area (1,277 sq. m.; pop., 1960, 288,833), which includes Peoria and Tazewell counties. The area had a value added by manufacture of \$487,559,000 in 1958; the city's value added by manufacture was \$216,571,000.

Peoria is the site of Bradley Univ. and of St. Mary's Cathedral (Roman Catholic) and the Cathedral of St. Paul (Protestant Episcopal). The public and parochial schools enroll ca. 21,000 annually.

The first permanent settlement on the site was made in 1819; the city was incorporated in 1845. The city's government is the manager-council system, adopted in 1953. In 1900 Peoria had a population of 56,700. Its decade of greatest growth



Courtesy Peoria Assn. of Commerce

PEORIA. SITE OF THE LINCOLN-DOUGLAS DEBATES

was from 1920 to 1930, which saw an increase from 76,121 to 104,969. The population in 1950 was 111,856; in 1960, 103,162.

Peoria Indians, a North American tribe of the Illinois Confederacy. Originally they resided on the shores of Peoria Lake in Central Illinois, but in 1673 they located themselves on the west side of the Mississippi River, near what is now the Des Moines River. In 1688 they moved from their Des Moines River settlement to the Upper Iowa River. After the war of the northern tribes against the Illinois Confederacy, some of the Peorias crossed over into Missouri, although the majority of the tribe remained on the east bank of the Illinois River until 1832. In that year the tribe, already greatly reduced in numbers, sold all its claims in Illinois and Missouri to the U.S., and moved to a reservation on the Osage River, in Kansas. In 1920 less than 100 full-blooded Peorias existed; it is now believed that very few, if any, of the original tribal stock remain.

Pepin Lake (*pěp'in*), an expansion of the Mississippi River, covering some 38 sq. m., between Goodhue and Wabasha Counties, Minnesota, and Pierre and Pepin Counties, Wisconsin, 60 m. below St. Anthony's Falls. It is nearly 22 m. long, being 2½ m. wide at some points. On its shores are the cities of Red Wing, Minn., Lake City, Minn., and Wabasha, Wis. The lake was formed from a natural dam or delta deposited by the Chippewa River, flowing in from the east. The swift current of the Chippewa carried down mud and silt too heavy for the Mississippi to carry, thereby forming the dam from which the lake emerged.

Pepin the Short (*pěp'in*), the youngest son

PEPPER

of Charles Martel and father of Charlemagne, born in 714; died in September 768. In 741 Charles Martel gave him as a heritage Burgundy and Neustria, while his elder brother, Carloman, received Thuringia, Swabia, and Austrasia. Their reign was largely influenced by the Merovingian sovereign, but in 751 Pepin became King of the Franks, succeeding Childeric, the last of the Merovingian kings. In 755 he invaded Italy as an ally of Pope Stephen III for the purpose of expelling the Lombards, and soon after established the temporal sovereignty of the Pope by making him ruler of Ravenna. His two sons, Charlemagne and Carloman, received the territories of Pepin under a division at his death. Pepin was not only an active and enterprising military commander and civil ruler, but he was the sovereign who united the Gallic nation. His surname, *The Short*, was given to him because he was short in stature, but he was noted for his physical strength.

Pepper (*pěp'ēr*), a class of plants native to the East Indies, but now extensively naturalized and cultivated. These plants include a large number of species, but the most important is the black pepper, *piper nigrum*. This is a climbing plant. It bears broad ovate leaves and globular berries, the latter being of a bright reddish color when ripe, for which it is grown in fields and plantations. Poles or other supports are provided for the plants, which bear fruit in three or four years, and the berries are picked when beginning to turn red. Their color afterward becomes black and the berries shrivel in drying, when they constitute the common or black pepper sold in the market. Two crops are obtained each year, the plants yielding about 10 pounds of pepper berries annually for 8 to 12 years. This product constitutes one of the most valuable and extensively used of the spices. Black and white pepper are made from the same berries. In order to secure white pepper, unripe berries are soaked in water before grinding and the outer covering is rubbed off. Formerly pepper was of an extraordinarily high price, but since the early part of the last century its cultivation has been greatly extended and the price became correspondingly cheapened. Sumatra, Java, Malacca, and India, are the most productive regions.

Pepper, CLAUDE DENSON, U.S. Senator, born at Dudleyville, Ala., Sept. 8, 1900. He studied at Alabama and Harvard universities, and after two years as instructor of law at the Univ. of Arkansas (1924-25), was admitted to the Florida bar (1925). He held various state offices until 1936, when he entered the U.S. Senate. A strong supporter of President F.D. Roosevelt, Pepper became one of the few Southern Democratic Senators who consistently backed New Deal legislation and co-operated with the CIO-PAC. At the National Democratic convention in 1944, Pep-

per was one of the leaders in the unsuccessful fight to renominate Henry Wallace (*q.v.*) to the vice presidency. Pepper was a consistent supporter of the Truman administration's domestic policies, but was defeated for re-election in 1950.

Pepper, WILLIAM, physician, educator, and author, born in Philadelphia, Pa., Aug. 21, 1843; died in Pleasanton, Calif., July 28, 1898. In 1862 he was graduated from the art department of the Univ. of Pennsylvania and two years later from the medical department of the same institution, where he was made a professor of medicine. He was elected provost of the university in 1881, but resigned in 1894. Pepper lectured and wrote extensively on historical, philosophical, and scientific subjects. In 1891 he was president of the American Assn. of Physicians and in 1893 of the Pan-American Medical Congress at Washington. In 1870 he founded the *Philadelphia Medical Times*.

Pepperidge (*pěp'ēr-īdĭ*), a vine plant with black berries, common in the southern U.S.

Peppermint Tree (*pěp'ēr-mīnt trē*), also called peppermint stringback and peppermint gum. It is related to the eucalyptus trees of Australia and is characterized by aromatic leaves. It reaches up to 400 ft. in height.

Pepsin (*pěp'sīn*), a digestive compound contained in the gastric juice of the stomach. It possesses the power, when united with hydrochloric acid, to dissolve the otherwise insoluble proteids and to convert them into peptones. Pepsin is a ferment. It is soluble in water, weak spirits, and glycerin, and its function is to render soluble and diffusible substances that would otherwise be fairly indigestible. When the food has been dissolved under its influence, it forms a grayish liquid called *chyme*. Both pepsin and hydrochloric acid are secreted by the stomach, and the vigorous action of that organ depends upon the proper production and union of the two. The exact nature of pepsin is not known, but it constitutes an essential element in the digestive process, and forms ordinarily about 80 per cent of the composition of the gastric juice. Pepsin is obtained from the stomach of the calf, pig, and other animals, and is used extensively in medicine as a stimulant in cases of disorganized digestion.

Peptone (*pěp'tōn*), a proteid soluble in water and not coagulable by heat. Peptones are produced in the stomach during the process of digestion. Peptone results from the action of the pepsin contained in the gastric juice upon the nitrogenous elements. See *Proteids*.

Pepys (*pěps*), SAMUEL, diarist, born in London, England, Feb. 23, 1633; died May 26, 1703. Notable chiefly as the author of a diary covering the years 1660-69, Pepys assured the privacy of his diary by writing it in a combination of short-



Courtesy National Portrait Gallery

SAMUEL PEPYS

Painting by John Hayls (died 1679)

hand and cipher. The minute account of his thoughts, his emotions, and his actions constitutes an extraordinarily full self-portrait, far franker and far more illuminating of character than diaries, journals, and letters written with eventual publication in mind. Since Pepys was not untypical of the gentlemen of the Restoration period, his diary gives us invaluable insight into the manners and mores of Restoration society and a good deal of gossip about the intrigue of the corrupt court of Charles II. An enthusiast for such things, Pepys conveys to us a contemporary view of the plays, concerts, and books of the period covered by his diary. His description of the great fire of London is an unforgettable record of the confusion, the terror, and the pathos of that catastrophe.

Pepys was not merely a diarist. He was an important permanent official of the navy and became secretary to the Admiralty in 1673. He was a member of the House of Commons, was proposed as head of King's Coll., Cambridge (although not selected), and in 1684 was elected president of the Royal Society. In 1679 he was accused of participation in a "Popish plot," and after the "peaceful revolution of 1688" he was imprisoned briefly for participating in a plot to restore the Stuarts to the throne. He is interesting to us because of his diary, but his diary is interesting because of his personality.

Pequots (*pě'kwōts*), or PEQUODS, a tribe of North American Indians, belonging to the Mohican family, first met with in Connecticut. In 1634 they entered into a treaty with the colonists at Boston, but soon after became hostile, and in 1637 were defeated near the present site of Groton, Conn. The struggle against them continued for a number of years, resulting in great

loss of life, but they were finally subdued in a battle at Fairfield Swamp. Thereafter they became widely scattered, and some were sold as slaves. At present the tribe is assimilated in part by other tribes, but a few of the descendants are found in Wisconsin, mostly at Green Bay.

Perak (*pě-rāk'*), a state in the Federation of Malaya (since 1948), situated on the west coast of the Malay peninsula. Perak, with its capital at Taiping, has an area of 7,980 sq. m.; its principal products are tin, rubber, and rice. The state was occupied by Japanese forces in 1942-45. Population, 1947, 953,938.

Per Capita (*pěr kă'pī-tā*), Latin meaning literally "by the head." Used in English, the term means "for each person." Thus the expression "per capita income of American farmers" refers to the total farm income divided equally by the total number of farmers.

Per Cent (*pěr sěnt*), abbreviation of the Latin *per centum* meaning "by the hundred," and represented by the sign (%). Percentage is used to express proportion in terms of number of significant units in each hundred of the total.

Perception (*pěr-sěp'shūn*), the faculty of the mind by which we gain knowledge, through the senses, of the existence and properties of matter. It is the power that the mind has of cognizing external objects and their qualities. Perception differs from *conception* in that it deals with things having an actual, not merely a possible, existence, and from *consciousness*, in that it is concerned with objects external to the mind. Writers have employed the term in various relations, and it is now sometimes applied to the act and product of perception as well as to the power of perceiving. Perception is both direct and acquired, since what the mind perceives through one sense enables us to know certain facts resulting at least in part from former experience of the different senses. See also *Psychology*.

Perch (*pěrch*), a genus of fish which includes many species, found widely distributed both in salt and fresh water. They are especially abundant in the northern part of the U.S. and Canada and are found in the ponds, rivers, and lakes of the northern part of Europe and Asia. The common fresh-water perch has a broad body flattened laterally, and two dorsal fins supported by strong bony spines. The color at the upper parts is greenish-brown. Blackish bands mark the sides and at the lower parts the color is a goldish-yellow. From one to three pounds is the usual weight. The perch feeds on smaller fishes, worms, and insects. It is fond of still waters. A species known as the *Sacramento perch* is found in the waters of California. The *yellow perch* common to the fresh waters of Canada and the U.S. is a favorite food fish and may be easily

propagated in artificial lakes and ponds. It seldom nibbles at the bait, but bites quickly at hooks baited with worms or minnows.

Percival (*pěr'sī-ŭal*), JAMES GATES, poet and geologist, born in Kensington, Conn., Sept. 15, 1795; died in Hazel Green, Wis., May 2, 1856. He graduated from Yale Univ. in 1815. After teaching school and studying medicine, he began a successful practice in Charleston, S. C. In 1824 he became professor of chemistry and surgery in the U.S. Military Acad., but was soon appointed surgeon in the recruiting service at Boston. In the meantime he contributed a number of articles to the *United States Literary Magazine*, published several volumes of poetry, and studied geology. He was made geologist and mineralogist of Connecticut in 1835 and in 1854 became geologist of the State of Wisconsin, where he afterward surveyed in the lead region for several mining companies. His writings include "Prometheus," "Clio," "The Dream of a Day," and "Collection of Poems." He is the author of several valuable geological reports.

Percussion (*pěr-kūsh'ūn*), in medicine, a method of detecting certain diseases of the chest and vital organs by means of tapping, or gently striking, the surface of the body. The object is to ascertain the presence or absence of air and fluid in certain internal organs, or to determine the comparative density of the subjacent parts by the nature of the sound. The tapping is sometimes done with the fingers or a small hammer tipped with India rubber, and the test is made on the surface of the body just above the place to be investigated. An instrument known as a *pleximeter* is sometimes used, and this is struck either with the fingers or a hammer. In some cases the *stethoscope* is employed in connection with percussion, when it is said to be *auscultatory percussion*. See *Auscultation*.

Percy (*pěr'sy*), the name of a celebrated Norman family, descended from William de Percy, who came to England with William the Conqueror in 1066. This sovereign granted him large tracts of land in the north of England, where his family held vast possessions for many years afterward. The house of Percy is the most distinguished of all the noble houses of England. It is alike remarkable for its culture of arts and letters and for its long, unbroken line. In 1766 the present dukedom of Northumberland was created in the Smithson family, which assumed and still bears the name of Percy.

Perelman (*pěr'el-man*), SIDNEY JOSEPH, humorous writer, born Feb. 1, 1904, in Brooklyn, N.Y. After his graduation from Brown Univ., he began writing for humorous magazines, including *Judge*, *College Humor*, and *The New Yorker*. His books include "Dawn Ginsbergh's Revenge" (1929), "Crazy Like a Fox" (1944),

and "Keep It Crisp" (1946). In addition, he has written two plays with his wife, "All Good Americans" (1934), and "The Night Before Christmas" (1941), and one musical comedy, with Ogden Nash, "One Touch of Venus" (1943). Perelman's humor is based on demolishing the clichés and the whimsy of other writers by taking their basic situations and extending them to fantastic conclusions.

Perez Galdos (*pă'râth gâl-dô's*), BENITO, novelist, born at Las Palmas, Canary Islands, May 10, 1845; died Jan. 3, 1920. He studied in his native town and at Madrid, completing a course of law. His first publication was issued in 1871 under the title "La Tontana de Oro," an historical romance relating to Spanish history. In this work and one entitled "El Audaz," he gives an account of the invasion of Spain by Napoleon and the tyranny of Ferdinand VII. His writings have been widely read both in Europe and in Spanish America. Besides producing many popular novels, he is the author of a number of plays, though they are inferior to his other writings. Among his publications are "Gloria," "Doña Perfecta," "El Doctor Centeno," "Ángel Guerra," "La Familia de León Roch," and "Episodios Nacionales."

Perfectionism (*pēr-fēk'shūn-iz'm*), a belief assuming perfection may be attained in this life and that man must strive for it. This attitude can be applied to the making of shoes or to scientific work, but essentially it is applicable to ethical behavior, and it is in the realm of ethics and religion that perfectionism becomes a governing attitude. The Roman Catholic Church, and to a certain degree also the Anglican and Lutheran churches, teach that man cannot live without sin since he has inherited the original sin of Adam. Protestant churches deny the attainment of perfection in this life; for them only a gradual progress toward the good can be achieved, and therefore the Protestant has to pray for forgiveness of sin. The Roman Catholic, however, believes that a special act of divine grace can relieve hereditarily sinful man of his heritage and so make him perfect. This is the state of sanctification or of complete consecration of the soul to God. All teachings of the mystics and to a certain degree those of the Friends and of certain Methodist sects try to bring adherents nearer to this goal, where all sin is annihilated and man participates in God. Devotion and contemplation are the means to this end, and man has to go through many stages in his growth toward grace.

A comparable idea can be found in the teachings of Brahmanism and Buddhism, which also express the concept that perfection can be achieved only gradually. The definite goal of perfection itself, however, is quite different from

the Christian idea of perfection, since it is identical with the dissolution in Nirvana (*q.v.*).

The term Perfectionist refers specifically to a sect of Americans who believed that complete perfection in the moral and religious sense could be achieved even in this earthly life. The movement was founded by John Humphrey Noyes, in Oneida, N.Y., in the 1840's; it also advocated a system of economic Communism, and for a time practiced complex marriage. The movement was suppressed in 1847, but some members remained together under the name of "Oneida Community." It was reorganized in 1881 as a co-operative enterprise.

Perfectionists (*pēr-fēk'shūn-ists*). See *Perfectionism*.

Perfumes (*pēr-fūmz*), fragrant substances which are prepared to emit pleasant odors. They are used on the person or in the dwelling to fill the air with an agreeable scent. The manufacture of perfumery dates from remote antiquity. It was a common art among the peoples of Assyria, Babylonia, Egypt, Phoenicia, and Palestine. The Greeks and Romans developed the manufacture of perfumes into an important industry. During the Middle Ages the enterprise spread to Western Europe. Two classes of perfumes are recognized in arts and trades, those derived from an animal and those from a vegetable origin and they are known in the market as crude and prepared. *Crude* perfumes are secured from animals or plants and are not mixed as special preparations, while *prepared* perfumes are sold under special names, being mixed according to particular formulae. Many classes of prepared perfumes are now sold on the market, usually in the form of alcoholic solutions.

Perfumes of animal origin include musk, ambergris, hartshorn, civet, and castor. *Musk* is the most important of these, since it has the most permanent scent. It is used largely in the preparation of commercial perfumes, and serves in that capacity to add durability and intensity to the fragrance of many sweet-smelling preparations. The vegetable perfumes include a large variety. They are made from flowers, as the violet, rose, and tuberose; from different kinds of wood, as sandalwood, sassafras, and cedar; from various fruits, as the lemon, orange, and bergamot; from seeds, as dill, caraway, and aniseed; from spices, the cloves, nutmeg, and cinnamon; from herbs, as the peppermint, lavender, and rosemary; from nuts, as vanilla and bitter almonds; from roots, as orris root; and from gums, as the styrax, camphor, and myrrh. Some of the vegetable perfumes are secured from plants and trees, from which they exude naturally, or are obtained from wounds inflicted artificially in the bark of wood. These include the gum resins, as benzoin, myrrh, and camphor.

Most of the vegetable perfumes are procured in the form of essential oils by distillation. These perfumes were formerly called *quintessences*, but now they are generally termed *ottos*, from the Turkish term *attar*, a word associated with the rose. Distillation involves the simple process of placing the fragrant product of the plant in a still of tinned copper, where a quantity of water is added. A small furnace underneath supplies the heat, and, when the water boils, the odorous parts are carried into the worm with the steam. Afterward, decanting is employed to separate the odoriferous parts from the steam or water that may have formed. Roses are gathered for distilling about the first of June and are placed in cool cellars until they can be distilled. All the roses of the harvest are distilled by a single process, when the product forms only *rosewater*, which is distilled a second time. The product now includes the sweet-smelling, oily *attar* in the form of little globules, but still contains a quantity of water. By placing it in small vessels, the oily *attar* comes to the top and is separated from the water by dipping it with a spoon. Two other processes for extracting perfumes, known as *enfleurage* and *maceration*, are employed to some extent.

The process known as *enfleurage* consists of putting a layer of grease, such as suet or lard, in a small box and placing the fresh blossoms of flowers on the grease. The box is carefully closed and allowed to stand about 24 hours and fresh flowers are added every 24 hours for several weeks, when the fat becomes filled with the perfume of the flowers and, after melting and straining, it is ready for use. The process of *maceration* consists of placing flowers in oil or melted fat for a few hours, when the fat is heated and the flowers are strained out. New flowers are added from time to time until the grease is highly perfumed, when the product is bottled for use, or the oil may be melted and combined with alcohol, by which volatile oil is extracted. Such flowers as the tuberose and jasmine are injured by heating and their perfumes are extracted by *enfleurage*, while in some cases both processes are employed. The manufacture of perfumes is an extensive industry in France, Germany, England, and many cities near the Mediterranean. Lavender is produced in large quantities in England, Nice leads in the production of violet and mignonette, and Cannes is a center for manufacturing perfumes from the jasmine, rose, and tuberose. The development of organic chemistry has resulted in determination of the components of oils and the synthesis of many pure aromatic compounds which greatly facilitate the perfume compounder's art.

Pergamum (*pûr'gá-mûm*), a city in the northwest of Asia Minor. In Greek legend, its

founding is connected with Telephus, the son of Hercules. Although of no great importance in its early stages, it was nonetheless large enough to strike its own coins before it actually began to play a larger role in the 3rd century B.C. It was only under its Kings Eumenes I (263-241) and Attalus I (241-197), who conquered the Gauls, that it achieved historic significance. The climax of its power was reached when Eumenes II (197-159) associated his country with the Romans. It was during this period that the great works of architecture and sculpture, which made Pergamum so famous, were created.

The city was similar in construction to Athens, being built under the protection of a high hill on which its acropolis (citadel) was located. Here were erected Pergamum's wonderful temples, the ruins of which are still partially preserved, among them the famous altar of Zeus, which was moved and re-erected in its entirety within the Pergamum Museum in Berlin, Germany. The walls of this altar are covered by a frieze in relief which ranks among the greatest works of later Greek (Hellenistic) art and its style became so prominent that archeologists speak of the independent Pergamian school.

At the end of the 2nd century, Pergamum became entirely Roman and flourished through the next three centuries. Still later it became one of the few early seats of Christianity. See also *Greece; Hellenism*.

Peri (*pě'r'i*), a being mentioned in Eastern legends as immortal, but who is excluded from Paradise. He is said to have descended from fallen spirits, and was thought to occupy a position midway between angels and demons. Many interesting fables mention peris in various relations, and belief in them is enjoined upon the Mohammedans by the Koran. Generally both grace and beauty are attributed to spirits of this class, when they are represented as female, though generally they are regarded as both male and female. When spoken of as male beings, they personify strength and skill in administering to the wants of mankind.

Pericarditis (*pě-r'i-kăr-d'i'tis*), in medicine, inflammation of the *pericardium* (*q.v.*), sometimes occurring after or in connection with such affections as rheumatic fever, Bright's disease, etc.

Pericardium (*pě-r'i-kăr-di-ûm*), the name of the sac which surrounds the heart. It is conical and membranous and consists of two layers. The *external* layer has many interlacing fibers, which, at the upper end, are closely interwoven with the external coats of the larger blood vessels, while the *internal* layer is composed of serous, lining membrane. A thin lubricating serous fluid is secreted by the pericardium, which serves to prevent friction and facilitates the movement of the heart.



PERICLES

Pericles (*pēr'i-klēz*), the most famous statesman of ancient Greece, born soon after 500 B.C., in Athens; died of the plague in 429 B.C. His life was influenced by the most favorable conditions. First, he was the son of a famous father, Xanthippus, who was the victor of the famous battle of Mycale (479 B.C.) over the Persians; secondly, he had a fine physique which enabled him to stand a tremendous amount of physical strain, and he had an excellent ability to assimilate the ideas of important thinkers. Thus, he studied with the leading philosophers of his time, including Senon, Anaxagoras of Clazomenae, and Protagoras. This equipped Pericles to acquire, when still young, a position of intellectual and political leadership among the Athenians. Even his personal reticence and aristocratic attitude proved to be no obstacles. After he had fought with Cimon (*q.v.*), he went into politics, consciously taking a stand as the representative of democracy, in contrast to the oligarchic (*q.v.*) attitude of Cimon. Pericles wanted to spread knowledge and physical well-being among all the citizens of Athens, and joined with all politicians who fought for pure democracy in Athens. Thus he supported the endeavors of Ephialtes to confine the power of the Areopagus, he introduced salaries for judges and soldiers (who had not been paid before), public kitchens, etc. In foreign politics, he fought for the supremacy of Athens over the other Greek city-states, e.g., Sparta, and he achieved the exile of Cimon who was favorably inclined toward Sparta. Pericles' political adversary Cimon, however, was

PERIODICAL

recalled four years later, but only as military leader; political affairs were left to Pericles who meanwhile had become the sole political leader of the Athenians. Before Cimon's recall, Pericles himself had fought with Sparta against Aegina, Cyprus, and Egypt. When Cimon died in 449 B.C. Thucydides became his successor as leader of the aristocratic group. However, he was exiled in 444 B.C., and Pericles once again was the sole ruler of Athens on a broad democratic basis. Pericles did not relinquish his power until his death.

Although Pericles had looked forward to a political union of all Greek states—after he had achieved peace for 30 years between Athens and Sparta—the Peloponnesian War broke out (431 B.C.), much against his intention.

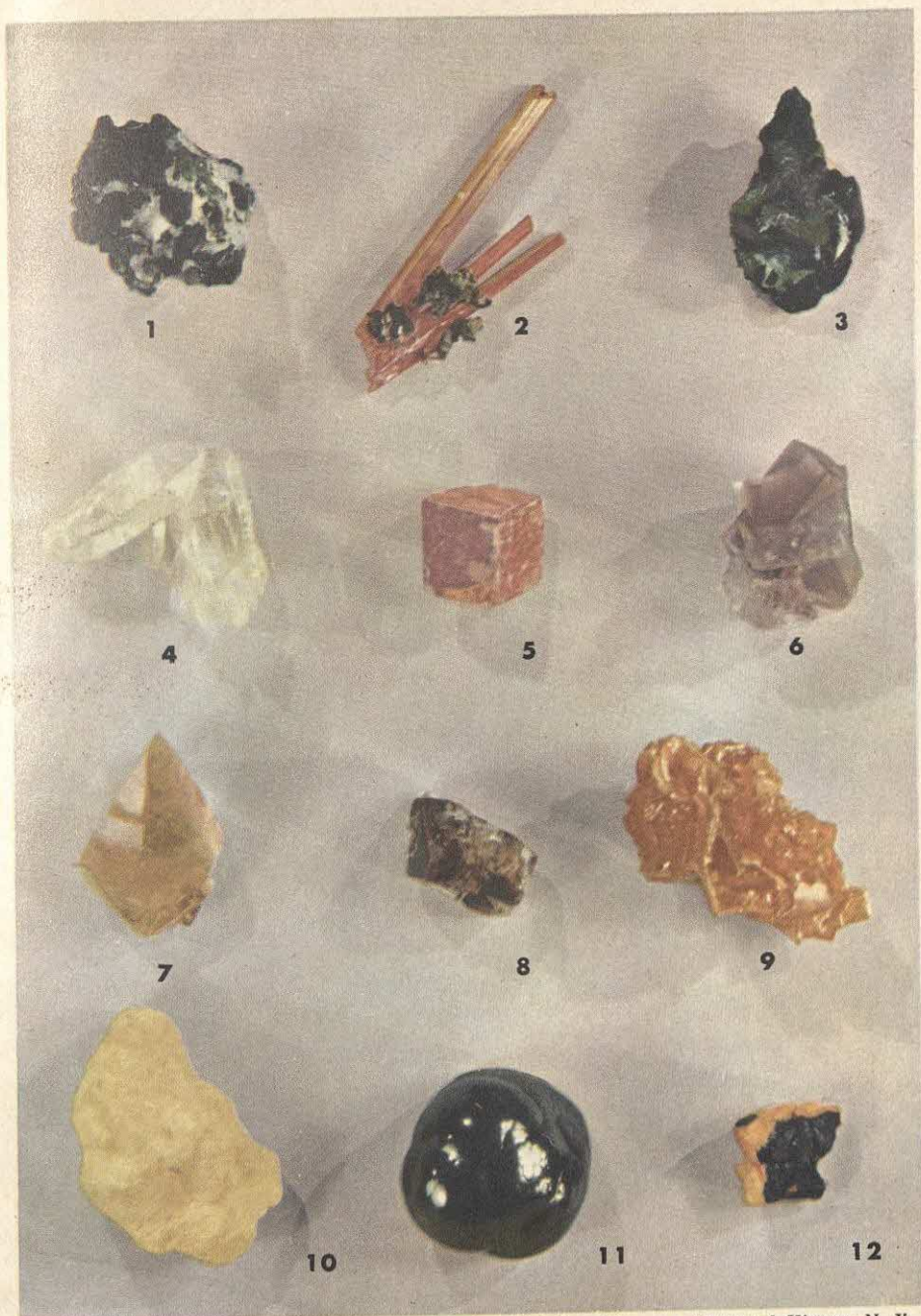
It was Pericles' pride that under his leadership Athens had reached a cultural climax. During his time, the Acropolis, with the Parthenon and the Erechtheion, had been erected, the greatest accomplishment of Greek architecture in the classical period. He commissioned Phidias, the greatest Greek sculptor, for the statue of the Athena Promachos and others. Polygnotos, a painter of equal fame, decorated public buildings. The dramatists Aeschylus, Sophocles, and Euripides wrote their famous works, and Aristophanes created his comedies. Herodotus and Thucydides wrote their great histories, and the philosophers Anaxagoras of Clazomenae, Empedocles, Democritus, and Protagoras joined with Socrates in lifting Greek philosophy to an unprecedented height. The age of Pericles has therefore always been considered as the most fortunate of all periods of Greek history, and the works of figurative arts, literature, and philosophy created at this time have been considered the high points of Greek civilization. This so-called "classical period" owed its flourishing to the administration and truly democratic public spirit of Pericles.

Periodontia (*pēr-i-ō-dōn'shī-ā*). See *Dentistry*.

Perim (*pē-rīm'*), an island in the strait of Bab el Mandeb, between Arabia and Africa. Its area is 5 sq. m. Politically a part of the British colony of Aden (*q.v.*), the island has little intrinsic importance except for its position at the entrance to the Red Sea. It was first occupied by the British in 1799 and was ceded to Great Britain in 1857. The island had an active port, largely devoted to supplying coal for ships, which was closed in 1936.

Population, ca. 360.

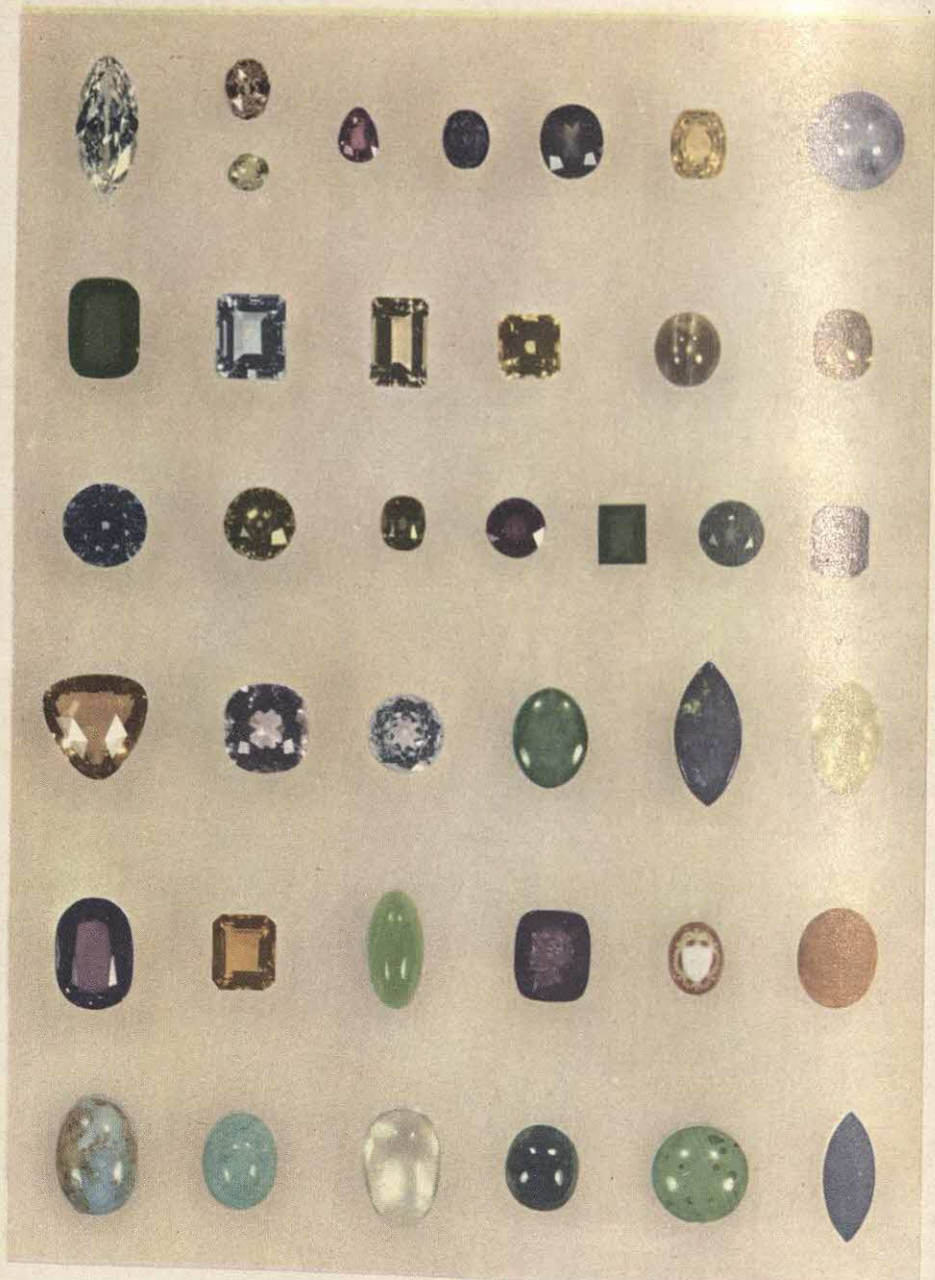
Periodical (*pēr-i-ōd'i-kal*), any serial publication, weekly, monthly, or quarterly, with the exception of newspapers. Periodicals range from the cheap "pulp" of poor fiction, such as Western, detective, and mystery magazines, to more schol-



Courtesy American Museum of Natural History, N. Y.

MINERALS AND STRATEGIC ORES

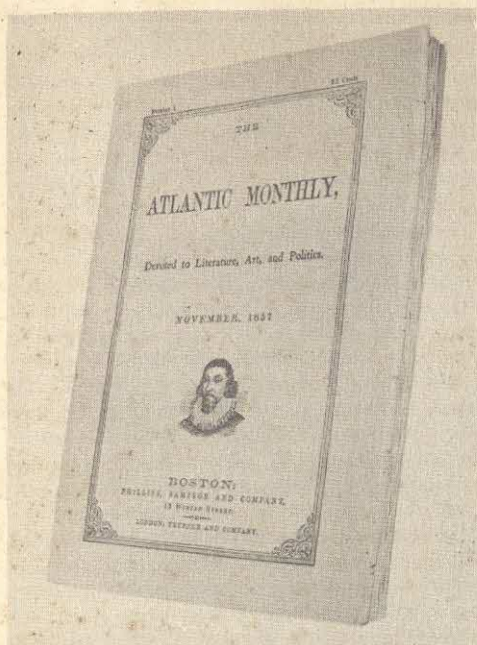
1. Diopside (Copper Silicate) S. W. Africa
 2. Crocoite (Lead Chromate) Tasmania
 3. Azurite and Malachite (Copper Carbonates) Arizona
 4. Quartz (Silicon Dioxide) Arkansas
 5. Rhodochrosite (Manganese Carbonate) Colorado
 6. Fluorite (Calcium Fluoride) Cumberland, Eng.
 7. Calcite (Calcium Carbonate) Joplin, Mo.
 8. Manganotantalate (Manganese Iron Tantalate) Brazil
 9. Wulfenite (Lead Molybdate) Arizona
 10. Carnotite (Potassium Uranium Vanadate) Colorado
 11. Hematite (Iron Oxide) Cumberland, Eng.
 12. Uraninite [Pitchblende] and Gummite (Uranium Oxide and Silicate) India
- (Chemical compound of mineral in parentheses)



Courtesy American Museum of Natural History, N. Y.

PRECIOUS STONES

First row: Diamond (Marquise cut), Rose and Green Diamonds, Ruby, Blue Sapphire, Green Sapphire, Yellow Sapphire, Star Sapphire. Second row: Emerald, Aquamarine, Morganite, Chrysoberyl, Cat's-Eye, Alexandrite. Third row: Blue Zircon, Brown Zircon, Green Garnet, Red Garnet, Green Tourmaline, Blue Tourmaline, Red Tourmaline. Fourth row: Brown Precious Topaz, Blue Topaz, Kunzite, Jade, Black Opal, White Opal. Fifth row: Amethyst, Topaz Quartz, Chrysoprase, Sard, Sardonyx, Carnelian. Sixth row: Turquoise Matrix, Turquoise, Moonstone, Azurite and Malachite, Malachite, Lapis-Lazuli.



FIRST ISSUE OF THE ATLANTIC MONTHLY

arly magazines and reviews, which may cover all branches of learning, religion, literature and art, politics, industry, professions, etc.

The first periodical published in America was the *General Magazine* published by Benjamin Franklin (*q.v.*), in 1741, in Philadelphia, Pa. Of the early magazines, the most notable were the *Pennsylvania Magazine* (1775), edited by Thomas Paine (*q.v.*), and Noah Webster's *American Magazine* (1787). In the early 19th century, a number of magazines of high quality were founded, the most important of which were: the *Port Folio* (1801-27), edited by Joseph Dennie (nicknamed the "American Addison"), which was devoted to pure literature; the *North American Review* (1815), which had a list of well-known contributors and was the organ of Harvard scholars; the *U.S. Literary Gazette* (1825-27), to which Longfellow (*q.v.*) contributed; the *Pioneer* (1843), containing tales by Poe (*q.v.*) and Hawthorne (*q.v.*); and *The Dial* (1840-44) which was edited by Margaret Fuller (*q.v.*), George Ripley, and Ralph Waldo Emerson (*q.v.*). In 1821 began the publication of the *Saturday Evening Post* which has continued until the present.

The 19th century also saw the rise of the generally circulated, nationally known monthly: *Graham's Magazine* (1826), with Poe as literary editor; *Godey's Lady's Book* (1830), and the *Southern Literary Messenger* (1834), edited by Poe, and *Frank Leslie's Illustrated Newspaper* (1855). In 1850, *Harper's New Monthly Magazine* caused a revolution in periodicals by its new

feature of serials of famous fiction. Soon after (1857), another well known periodical was founded in Boston, the *Atlantic Monthly*. That same year saw the launching of *Harper's Weekly* (1857-1916), an illustrated periodical in which the famous political cartoons of Thomas Nast (*q.v.*) appeared. A new era was inaugurated in the nineties by a better type of illustrated magazine and by the appearance of the magazine designed to appeal to women: *Ladies' Home Journal* (1883), *Cosmopolitan* (1886), *McClure's Magazine* (1893-1933), *Collier's* (1887), *Liberty* (1924). In 1922, the *Reader's Digest* began another new type of periodical, when it published condensations of important and interesting articles which had recently appeared in other magazines. *Time*, with its witty and vivid presentation of news, which has exercised great influence on American journalism, was founded in 1923. Later the *Time* organization launched two other magazines: *Life* (1936), having bought its name from the former humorous weekly, was devoted primarily to carrying the news in pictures, and *Fortune*, designed to appeal to businessmen. These magazines have given rise to a host of similar periodicals, of which the best known are *Newsweek*, resembling *Time*, and *Look*, on the pattern of *Life*.

FIRST ISSUE OF THE NEW YORKER

"Eustace Tilley," drawn by Rea Irvin, is *The New Yorker's* idea of itself. Designed in 1925 for the first issue, Tilley has since appeared on the cover of every February anniversary issue



The 20th century saw a vast multiplication of periodicals. Among the better-known modern periodicals, apart from those already mentioned, are: *American Journal of Public Health*, *American Mercury*, *Asia*, *Better Homes and Gardens*, *Business Week*, *Journal of Political Economy*, *Catholic World*, *Current History*, *Education*, *Foreign Affairs*, *Foreign Policy Reports*, *Forum*, *Harvard Law Review*, *House and Garden*, *Nation*, *New Republic*, *New Yorker*, *Political Science Quarterly*, *Saturday Review of Literature*, *Scribner's Magazine*, *Survey Graphic*, *Yale Review*, *Virginia Quarterly*, *National Geographic*, *Woman's Home Companion*, *International Affairs*.

Coincidental with the rise of periodicals devoted to general diversion and entertainment has been the rise of the trade magazine. Today almost every profession or trade has one or more periodicals covering happenings and progress in it. Examples of these special periodicals are *Editor and Publisher*, a review of events in the newspaper world, and the *Rural New Yorker*, and *Iowa Homestead* and *Wallace's Farmer*, covering agriculture; *Science Digest*, *Popular Science*, and *Popular Mechanics* exemplify an important type of specialized periodical which has developed in conjunction with the tremendous advances in the technical and scientific fields.

Something new appeared on the literary horizon in the 20th century in the form of the little magazine. Symbolic of the revolt of artists and writers against what they considered provincialism, the little magazines were designed by and for intellectuals. They were sometimes regional, and presented political essays, criticisms of literature and the arts, and original literary work. Among the most outstanding was *Poetry* (1912), edited by Harriet Monroe, who first published the poetry of T.S. Eliot (q.v.) and provided a showplace for the writings of such other modern poets as Amy Lowell (q.v.), Hart Crane (q.v.), and Ezra Pound (q.v.). Other little magazines were the *Dial* (1920-29), namesake of the earlier transcendental organ, and an influential review of the arts: *Seven Arts*, *Hound and Horn*, *Partisan Review*, *Transition* (which was published in Paris), and the *Masses* (1911-17), magazine of the political radicals, later succeeded by the *New Masses*. These were typical of the period from 1900 to the middle 1930's. The years just preceding and during World War II saw a new revival of the little magazines, as for instance, the *Southern Review*, which lasted for seven years, expiring in 1942, and the *Kenyon Review* and the *Sewanee Review* which, with the still current *Partisan Review*, are the most influential today.

The importance of the little magazines lies in the fact that although they have had small

circulation, they have pushed the work of contemporary writers whose themes and styles were not acceptable to the large circulation magazines; they have also pushed the work of Europeans such as Rimbaud, Proust, and Joyce, whose writings have had tremendous impact on the course of modern literature.

Two types of magazine which have a wide appeal among children, although read by many adults as well, are the "gag" magazine, and the comic magazine also called a "comic book." The "gag" magazine is made up of cartoons with accompanying humorous lines, or "gags." The comic magazine consists of one long story or several short stories told in the style of the comic strip, and usually in color. The effect of the comic magazines upon children has been criticized by many parents and educators who believe that the exciting and fantastic nature of the stories told is unhealthful. The power of the comics as an educational form is attested to by the fact that the armed forces have used this medium as a means of communicating information.

America was the first country to institute the children's magazine with *The Young Misses' Magazine*, published in Brooklyn in 1806. *St. Nicholas* (1873), and *Youth's Companion* (1827) were the best-known current children's periodicals.

In England the periodical arose in the 17th century and reached its peak in the 18th with such famous periodicals as the *Tatler* (1709), the *Spectator* (1711), and the *Guardian* (1712) published by Addison (q.v.) and Steele (q.v.), and the *Examiner*, to which Swift (q.v.) contributed. The most famous magazine of the mid-18th century was the *Gentleman's Magazine* (1731) which carried political, legal, historical, critical, and other articles. Modern English magazines include *Horizon* (1939), *Criterion* (1922), *Life and Letters* (1928), *London Mercury* (1920); historical and scientific periodicals are the *English Historical Review* (1886), *Asiatic Review* (1875), *Law Quarterly* (1885); the *English Illustrated Magazine*, and the *London Illustrated News* are the most well known among many magazines of that type; *Punch* is the most famous satirical cartoon-type magazine; other well-known magazines are *My Home* (1928) and *My Garden* (1934).

The first Canadian periodical was *The Canadian Magazine* (1823). Later appeared *L'Observateur* (1830), *The Queen's Quarterly* (1893), *Canadian Forum* (1920), *Le Canada Français* (1888).

Periostitis (pĕr-i-ōs-tī'tis), in medicine, an inflammation of the *periosteum*, the membrane covering the bones.

Peripatetic Philosophy (pĕr-i-pā-tĕt'ik fil-

ô-s'ô-fy), a Greek school of philosophy of the 4th century B.C., founded by Aristotle (*q.v.*) and later continued by his disciple and friend, Theophrastus (*q.v.*). The name peripatetic was derived from the philosopher's habit of walking around (in Greek, *peripatein*) while discussing and thinking. Peripatetic philosophy tended to emphasize less the metaphysical aspects of Aristotelian philosophy, than the problems of ethics and of the right form of life. Right behavior is explained by the Peripatetics as the exercise of virtue which conforms to reason. To behave ethically means to behave reasonably. Reason can be attained by logical thinking and, in daily life, by leaning on and learning more and more about nature. In this study any abstract speculation must be shunned; reality must be the only gauge. In the opinion of the Peripatetics, the human mind (*Nous*) itself has developed from the lowest steps of organic life, which already contain it. Beyond this concept, the Peripatetics do not answer definitely any questions about the character of the human mind. Since Aristotle did not answer the ever-present question of the immortality of the soul, it was left as one of the most important problems of the Peripatetic philosophers, who included followers of many different schools.

Periscope (*pěr'i-skôp*), an optical instrument for conveying images around corners or to submerged submarines. The optical system of the periscope is similar to that of the telescope with the addition of two reflecting prisms to turn the light rays at right angles to their initial direction. The periscope for submarines is enclosed in a telescoping tube which may be extended above the surface of the water. Rays of light traveling along the surface are reflected downward by the top prism and enable an observer in the submarine to scan the surface.

Peritonitis (*pěr-i-tô-ni'tis*), in medicine, an inflammation of the *peritoneum*, the membrane which covers the abdominal organs. It is usually caused either by a sepsis or by a mechanical perforation of the peritoneum. It can result from appendicitis or indirectly through the diaphragm as a consequence of pneumonia.

Peritonitis (*pěr-i-tôn'si-li-tis*). See *Quinsy*.

Perjury (*pěr'jûrî*), the crime of willfully making a false statement while under oath or affirmation, or willfully giving false testimony material to the issue or point in a case at law. To constitute perjury, the oath or affirmation must be lawfully administered, the false swearing must be willful and corrupt, the matter sworn to must be material to an inquiry or investigation, and must be before an officer created by law or in a proceeding in a court of justice. In some states the act of making an affirmation about a matter in regard to which a witness has

no knowledge is held to be perjury. The punishment provided is by fine or imprisonment, or both.

Perkin (*pěr'kîn*), SIR WILLIAM HENRY, chemist, born at London, England, in 1838; died in 1907. He produced the first synthetic dye in 1856, and a year later established the first aniline dye industry at Harrow. Among the synthetic dye products which he discovered are alizarin, or red madder, coumarin from the tonka bean, and cinnamic acid from benzaldehyde. The last-named process is known as the Perkin reaction. He conducted researches on the chemical changes effected when polarized light is rotated in a magnetic field. Perkin received many scientific honors and was knighted in 1906.

Perkins (*pěr'kînz*), ELLI. See *Landon, Melville De Lancey*.

Perkins, FRANCES, former Secretary of Labor, born at Boston, Mass., Apr. 10, 1882. She was graduated from Mt. Holyoke Coll. and attended the universities of Chicago, Pennsylvania, and Columbia. Early interested in the problems of labor, she served as secretary to the Research and Protective Assn. (1907-09), later holding positions with the Consumers' League, the New York State Factory Commission, and the New York Council of Organizations for War Service. She was a member of the State Industrial Board (1923-28), when she became Industrial Commissioner at the head of the State Dept. of Labor. In 1933, President F.D. Roosevelt appointed her Secretary of Labor, and she thus became the first woman in the history of the U.S. to hold a cabinet position. Early in the Truman administration, she resigned, and in 1946 joined the faculty of Radcliffe Coll., Mass. Later in 1946, she was appointed to the U.S. Civil Service Com-

FRANCES PERKINS

Courtesy Viking Press, N. Y.



mission by President Harry S. Truman. Although married to Mr. Paul Wilson of New York, she is publicly known by her maiden name. She is the author of several books on labor problems and, in 1946, published "The Roosevelt I Knew," a portrait of the late President.

Perm (*pěrm*), former name of MOLOTOV, a city of the U.S.S.R., located 720 m. E. of Moscow, at the head of navigation on the Kama River. An important junction on rail routes between Siberia and Central Russia, its numerous products include phosphate fertilizers and electrical goods. It has a state university and a polytechnic institute. During the Russian Revolution (1917), Perm was temporarily held by White Russian forces. Population, over 250,000.

Permanent Court of Arbitration (*pěrm'ng-něnt kōrt ov ār-bī-trā'shūn*). See *Arbitration*; *United Nations*.

Permanganates (*pěrm-māng'gā-nāts*), salts of permanganic acid (HMnO_4). The acid itself has been found only in solution. Potassium permanganate, prepared from the ore pyrolusite (MnO_2) and potassium hydroxide (KOH), is the most important permanganate. It is a deep-purple crystalline solid, which gives an intensely purple solution in water. Like all permanganates, it is a strong oxidizing agent, and for this reason it is used as a disinfectant, as a wood preservative, and in water purification. Because potassium permanganate liberates oxygen easily, it should be kept away from all combustible material.

Permanganic acid, although it has never been isolated, has been shown to be a strong acid and can be prepared by dissolving the oxide Mn_2O_7 in water. Like other permanganates, it is purple. See *Antiseptics*; *Bleaching*.

Permian, a period or system of the youngest major geologic subdivision of the Paleozoic era (*q.v.*). The period was named by Murchison in 1841 for rocks exposed on the western flank of the Ural Mtns. in the Russian Province of Perm.

This period existed for approximately 25,000,000 years and is noted for widespread aridity and glaciation. Some volcanic activity occurred, however.

For plants and animals the Permian period was a time of crisis. Living conditions were especially difficult for plants due to rapid fluctuations of extreme climatic conditions. Many previous plant forms died out, and plants that were more adaptable to severe climates appeared. Insects and animals were abundant. Many of the vertebrate animals were capable of surviving on land or in water.

Rocks deposited during the Permian period in the U.S. occur in large areas in the western part of the country from the Great Plains to the Pacific Ocean. The most complete section of the Permian

system in the U.S. is in western Texas and southeastern New Mexico, where about 7,000 ft. of sedimentary strata accumulated. Sedimentary rocks of Permian age also occur in southeastern Ohio, southwestern Pennsylvania, and northwestern West Virginia. Among the important economic products found in strata of Permian age are oil, copper, coal, rock salt, potash, and rock phosphate.

Permutation (*pār'mū-tā'shūn*), as used in mathematics, refers to a set of elements selected in a definite order from a larger set, or from a set of the same size. For example, the permutations of two letters that can be selected from the four letters *a, b, c, d* are *ab, ac, ad, ba, bc, bd, ca, cb, cd, da, db, dc*. Thus the number of permutations in this case is 12. If permutations of *r* elements each are selected from a set containing *n* elements ($n \geq r$), then the number of permutations that can be formed is denoted by nPr , and its value can be computed from the formula

$$nPr = n(n-1)(n-2)(n-3) \dots (n-r+2)(n-r+1).$$

When $n=r$ this formula becomes

$nPn = n(n-1)(n-2)(n-3) \dots 3 \cdot 2 \cdot 1$. This product is the product of *n* by all of the integers smaller than *n*, and it is usually denoted by $n!$ or $n_!$, read "factorial *n*."

The entire theory of permutations is based on the fundamental principle of choice which may be stated as follows: If one of two independent events can be done in *a* ways and the second can be done in *b* ways, then the two events can be done in succession in $a \times b$ ways. As an illustration of this fundamental principle, consider a railroad trip from San Francisco to New York City with a stopover in Chicago. If there are three railroads between San Francisco and four between Chicago and New York City, the trip could be made in 12 different ways, since for each of the three choices of the first railroad there are four choices of the second railroad. See also *Combination*.

Pernambuco (*pěrm-nam-bōō'kō*), a state in northeastern Brazil, bordered on the E. by the Atlantic Ocean. It produces sugar cane, tobacco, coffee, and livestock. The capital is Recife (*q.v.*). Area, 37,458 sq. m. Population, 1950, 3,430,630.

Perón (*pā-rōn'*), JUAN DOMINGO, President of Argentina, born in Lobos, Argentina, Oct. 8, 1895. A graduate of the Argentine military school, he was an obscure army officer until June 1943 when he emerged as the leader of the "GOU," a clique of army officers, who overthrew the regime of Pres. Ramón Castillo. A tightly organized military group with totalitarian leanings, the so-called "colonels' group" dominated the succeeding administrations. About a year later, under Pres. Edelmiro Farrell, Perón



Courtesy Wide World Photos

JUAN DOMINGO PERÓN

was minister of war and head of the national labor department. His power expanded until, toward the end of the regime, he rose to vice president. By capturing the labor vote, Perón was elected president in 1946 and re-elected in 1951. His attacks on the Church crystallized popular opposition, however, and, in September 1955, a revolt led by the armed forces caused his overthrow. Forced to leave Argentina, Perón won political asylum in other South American countries but mostly for brief periods only.

Generally, Perón's policies had followed the Fascist pattern of unrestricted totalitarian power, government control of business and labor, and subordination of the individual to the state.

Argentine-U.S. relations were severely strained during Perón's first term and remained uncordial throughout his regime.

His wife, EVA DUARTE DE PERÓN (born in Los Toldos, Argentina, May 7, 1919; died in Buenos Aires, July 26, 1952), a former actress, became popular for her social welfare activities for the *descamisados*, or "the shirtless ones," the Argentine lower class. See also *Argentina*.

Perov (*pyĩ-róf'*), VASSILI, painter, born in Tobolsk, Russia, Dec. 21, 1833; died in Moscow, May 29, 1882. After studying art in Moscow, Perov went to Paris, where he was influenced by the great French realist Gustave Courbet (*q.v.*). Returning to Moscow, he introduced forceful realism into Russian art. Perov was highly successful as a painter of portraits and historical and genre subjects, notable for facile brushwork and a suggestion of social content.

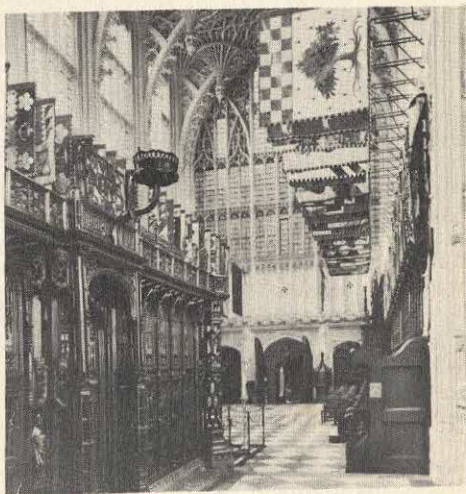
Peroxide (*pěr-òks'íd*). See *Oxygen*.

Perpendicular Style (*pěr-pèn-dik'ù-lēr*), in architecture, the name given to the last period of English Gothic (*q.v.*). It began slowly around 1360 and developed until the 16th century, when Renaissance forms began to supersede the Gothic style. The principal marks of the Perpendicular

PERPIGNAN

style are the fan vault and the substitution of applied carving and architectural motifs for carved foliage; the vertical tendency is increased to the utmost. Two of the best examples of the fully developed Perpendicular style are King's Coll. Chapel in Cambridge and the Henry VII Chapel of Westminster Abbey, both of which were finished in the 16th century.

Perpetual Light (*pěr-pěch'ù-ql*), a lamp kept burning constantly in synagogues, above the



Courtesy British Information Services, N.I.

PERPENDICULAR STYLE

A chapel of Westminster Abbey, built in 1503

Ark of the Covenant, in accordance with the command "to cause the lamp to burn always" (Exodus 27:20, Leviticus 24:2). It is a symbol of the eternal light of Judaism.

Perpetual Motion, a hypothetical state of motion able to continue indefinitely. Perpetual motion is never actually possible. Perpetual motion of the "first kind" requires a machine that can spontaneously create its own energy; such machines are prohibited by the law of conservation of energy (see *Energy*). Perpetual motion of the "second kind" requires a machine capable of extracting energy from a source and completely converting it into usable work; such machines are prohibited by the second law of thermodynamics (*q.v.*). Many devices have been invented that are claimed to produce perpetual motion, but none has ever done so.

Perpignan (*pār-pèn-yăn'*), a city in France, capital of the department of Pyrénées-Orientales, 35 m. s. of Narbonne. It is on the Têt River, 5 m. from the Mediterranean. Perpignan is a trade center for wine, olive oil, fruits, and wool; its manufactures include paper products, silk and woolen fabrics, and leather goods. France and Spain contested for

its possession until 1659, when it was given to France by the treaty of the Pyrenees. Its ancient citadel, cathedral, museum, and library, however, show a strong Spanish influence architecturally. Population, 1954, 70,051.

Perrault (pă-rô'), CHARLES, author, born in Paris, France, Jan. 12, 1628; died May 16, 1703. He was the son of an advocate, received a liberal education, and in 1651 was admitted to the bar at Paris. He practiced law for several years and afterward became controller-general of the royal buildings. After producing a number of literary treatises, he was admitted to the French Acad. He soon became involved in controversies regarding literary criticisms, in which many of the learned men of France became interested. Perrault is not famous so much for the invention of the subjects of his writings, which consist largely of fairy tales, but in adapting them to a literary style of much beauty and childlike fancy. His best-known stories include "Bluebeard," "Little Red Riding Hood," "Sleeping Beauty," "Cinderella," and "Riquet of the Tuft." His "Memoirs" were published in 1759.

Perrin (pě-răn'), JEAN BAPTISTE, physicist and chemist, born in Lille, France, Sept. 30, 1870; died Apr. 18, 1942. Perrin's first important work was his discovery of the equilibrium between the gravitational field and molecular motion in colloidal solutions, a discovery which permitted a more accurate calculation of atomic size in some cases. He also did research on the Brownian movement and problems of the electrical contact potential. In 1926 he was awarded the Nobel Prize for physics for his work on "discontinuity in the structure of matter, and . . . for his discovery of the equilibrium of sedimentation."

Perry (pě-r'i), county seat of Noble County Oklahoma, on the Atchison, Topeka & Santa Fe, and the St. Louis & San Francisco R.R.'s. The surrounding country is fertile, producing wheat. Dairying and the raising of livestock and poultry are carried on. There are several producing oil fields in the vicinity. Population, 1950, 5,137.

Perry, BLISS, author and educator, born at Williamstown, Mass., Nov. 26, 1860; died in Exeter, N.H., Feb. 13, 1954. After studies in the U.S. and abroad, he taught at Williams Coll. (1886-93), Princeton (1893-1900), and Harvard (1907-30) as professor of English. He also was editor of the *Atlantic Monthly* (1899-1909), and of the Cambridge edition of poets, as well as the prose of Emerson, Burke, and Scott. His original works include "A Study of Prose Fiction" (1902), "The American Mind" (1912), "Carlyle" (1915), "The American Spirit in Literature" (1918), "A Study of Poetry" (1920), and his memoirs, "And Gladly Teach" (1935).

Perry, JAMES DE WOLF, clergyman, born in Ger-

mantown, Pennsylvania, Oct. 3, 1871; died Mar. 20, 1947. He was educated at the Univ. of Pennsylvania and the Episcopal Theological School, Cambridge, Mass. After holding rectorships in Massachusetts and Connecticut, he served as Bishop of Rhode Island (1911-46). From 1930 through 1937 he was Presiding Bishop of the Protestant Episcopal Church. He is remembered for his personal graciousness, his appreciation of the contribution of the Episcopal Church to the cultural life of the U.S., and his clear conception of the increasing importance of that church to the life of the Anglican Communion.

Perry, MATTHEW CALBRAITH, naval officer, brother of Oliver H. Perry, born in Newport, R.I., April 10, 1794; died in New York, N.Y., March 4, 1858. He entered the Navy in 1809 and took part in the War of 1812, after which he captained a merchant vessel. Later, returning to active duty in the Navy, he was executive officer of a vessel sent (1820) to Africa to help establish the American Negro colony later named Liberia. A master commandant in 1826 and a captain in 1837, Perry commanded the *Fulton*, one of the first U.S. naval steamships. In 1833 he became second officer of the New York Navy Yard; in 1837 a naval apprentice system he had developed was adopted by Congress. He was commander of the naval squadron organized (1843) to suppress the African slave trade. In the Mexican War (1846-48) he commanded a squadron off the Gulf coast and aided Gen. Winfield Scott at Vera Cruz. On March 31, 1854, he concluded a treaty opening Japan to the West.

Perry, OLIVER HAZARD, naval officer, born in Newport, R.I., Aug. 23, 1785; died at Port of Spain, on the island of Trinidad, Aug. 23, 1819. He entered the U.S. Navy as midshipman in 1799, became lieutenant in 1807, and in 1812 was transferred from a command on the Atlantic coast to do duty on Lake Erie under Commodore Isaac Chauncey. At Presque Isle (now Erie) he was chosen to superintend the building of a number of small vessels. His squadron fitted up in this manner consisted of nine vessels, with which he attacked the British fleet under Capt. Robert Barclay, who had a flotilla of six vessels of larger size. The squadron under Perry sailed from Put-in Bay on Sept. 10, 1813, and on the same day captured the entire British flotilla. His announcement of the event to the government was his famous dispatch: "We have met the enemy and they are ours." Perry was accorded a vote of thanks by Congress and the rank of captain was conferred upon him. This victory was important because it caused the British to lose control of Lake Erie and they were compelled to evacuate Detroit. After the war he served in the Mediterranean and in 1815 commanded a squadron in the

PERRYVILLE

Caribbean Sea. He died of yellow fever, contracted on a trip up the Orinoco River.

Perryville (*pĕr'i-vīl*), BATTLE OF, an engagement of the Civil War in the U.S., fought at Perryville, Ky., on Oct. 8, 1862. Gen. Bragg had a Confederate force of 17,000 men and made an attack upon a Federal force of 22,000, under command of Gen. McCook. The latter were at first driven back, but they finally compelled the Confederates to retreat through Perryville, and during the night they retired from the field. The engagement was a strategic victory for the Federals, although it is usually looked upon as a drawn battle. The Confederates lost 3,450 men, while the Federals lost 4,200.

Persephone (*pĕr-sĕf'ō-nĕ*). See *Proserpina*.

Persepolis (*pĕr-sĕp'ō-lis*), a city of ancient Persia, which is famous for its former importance and the remarkable ruins on its site. It was located in a fertile valley near the confluence of the Medus (now Polwar) and the Araxes (now Bendemir) Rivers, about 35 m. N.E. of Shiraz. Persepolis is the Greek name, its Persian name being now unknown. The city was one of the capitals of Persia. Its founding is ascribed to Cyrus, though some writers think it was not the capital until many years after his time, and that it became the residence of Darius, Xerxes, and Artaxerxes. Many of the leading monarchs of Persia were buried here. On its site are many remains of marble columns, bas-reliefs, huge figures, walls, and other notable ruins. Alexander the Great destroyed the city in 331 B.C.

Perseus (*pĕr'sĕ-ŭs*), in Greek legend, the son of Zeus and Danaë, daughter of Acrisius, King of Argos. An oracle foretold that a son of Danaë would cause the death of Acrisius, and he accordingly imprisoned her in a tower of brass, but Zeus, by supernatural means, made her his bride. Four years later, when Acrisius discovered the marriage and learned that a child had been born, he promptly ordered that the mother and child should be thrown into the sea. Under the direction of Zeus, the chest bearing the child floated safely to one of the Cyclades, the island of Seriphus, where Perseus was protected by the king of the island under promise that he would slay the Gorgon Medusa and bring her head to him. After reaching the dwelling of Medusa, near Tartessus, he cut off her head with the sickle furnished by Hermes, and on his return liberated Andromeda from a sea monster.

Pershing (*pĕr'shīng*), JOHN JOSEPH, American general, born in Linn County, Mo., Sept. 13, 1860; died in Washington, D.C., July 15, 1948. He was graduated from the U.S. Military Acad. at West Point in 1886, was assigned to frontier duty, and served in Cuba (1898) during the Spanish-American War. After seeing service in



Courtesy U. S. Navy

JOHN J. PERSHING

the Philippines (1899-1903), he became U.S. military attaché in Tokyo (1905-06) and accompanied Kuroki's army in Manchuria (1905). Promoted to brigadier general, he was made commander of the Department of Mindanao and governor of the Moro Province, P.I., where he successfully subdued hostile native tribes in the insurrection of 1913. In 1916 he led U.S. forces sent in pursuit of Pancho Villa, the Mexican revolutionist, and in the same year, he was promoted to major general. Upon the entrance of this country into World War I, he was made commander-in-chief of the American Expeditionary Force (1917-19) and full general (1917); his military leadership has been largely credited with the ultimate Allied victory. After World War I he was made General of the Armies, and was the only officer in U.S. military history to hold this title. In 1921 he was appointed chief of staff of the U.S. Army, holding this post until 1924, when he retired from active service. His memoirs, "My Experiences in the World War" (1931), was awarded the Pulitzer Prize for history.

Persia (*pĕr'zhā*), a kingdom in the western part of Asia, officially called *Iran*. The name Persia is applied locally only to a small province, but for a long time it included the entire country. It is bounded on the N. by Russian territory and the Caspian Sea, E. by Afghanistan and Baluchistan, S. by the Arabian Sea, and W. by the Persian Gulf and Asiatic Turkey. It extends about 900 m. from east to west and 700 m. from north to south. Area, about 628,000 sq. m.

DESCRIPTION. The surface consists principally of an elevated plateau, much of which is desert, and along the western and northern boundaries are vast areas broken up by chains of rocky and



Courtesy Ewing Galloway, N. Y.

ANCIENT PRACTICES STILL PREVAIL IN RURAL PERSIA

Merchants use the primitive balance scale with stones as weights

precipitous mountains. The eastern part is quite level, but elevated, and along the Arabian Sea and Caspian Sea are tracts of fertile coast plains. The general elevation of the interior ranges from 2,000 to 6,250 ft. above sea level, while the Elburz Mts., paralleling the Caspian Sea, rise to nearly 20,000 ft., Mt. Demavend being the culminating peak. This mountain is a nearly extinct volcano, altitude 18,500 ft., and from its summit may be seen a vast stretch of country. West of the Caspian Sea are the mountains of Ararat, and along the Persian Gulf are several ranges that approximate 16,500 ft., including the range known as Kuh-Dinar. In the interior are two deserts, known as the Great Salt Desert, or Dasht-i-Kavir, in the north central part, and the Great Sand Desert, or Dasht-i-Lut, in the southeastern section.

The rivers of the interior are few and unimportant, and fully two-thirds of the surface is not drained into the sea, but the drainage is lost in the sands or swamp lands. Lake Urumiah, in the northwest, is the most important body of water, but there are fully 30 small inland saline lakes, covering a considerable area and having no visible outlets to the sea. The Euphrates forms a small portion of the western boundary and is the only river of importance in navigation, though the Karun has been improved by jetties and canals for small boats. A number of small streams flow into the Caspian Sea, including the Atrek and the Sefid Rud.

The climate of Persia varies according to location and elevation. In the central part the summers are extremely hot and the winters are cold. The region lying adjacent to the Persian Gulf has remarkably hot and oppressive summers and

the winters are quite moist. As a whole the rainfall is limited, some regions being particularly arid, but along the Caspian and Arabian Seas and the Persian Gulf there is an abundance of moisture and a dense growth of forest. Among the more important trees are the elm, oak, walnut, beech, cypress, cedar, box elder, and cottonwood.

MINING. Though rich in mineral wealth, mining has not been developed extensively as an industry. Turquoises of considerable value are obtained in Nishapur and other parts of Khorasan, the northeastern province. Salt is obtained in large quantities in the region lying inland from the Persian Gulf, which contains deposits of nickel, iron ore, gypsum, and sulfur. The coal fields are chiefly in the northern section and the province of Kerman, in the southeastern part, is rich in lead, copper, and marble. Other minerals include antimony, cobalt, nitrates, and asbestos. The country is rich in petroleum.

INDUSTRIES. Agriculture is one of the leading industries. It is carried on partly in regions of sufficient natural moisture by nature and partly in irrigated districts, but the methods of farming are crude and primitive. Wheat, barley, and rice are the principal cereals. Cotton of a superior quality is grown. Considerable amounts of silk are produced in the plains bordering on the Caspian Sea. Tobacco of a superior quality is grown for export. The poppy was introduced in 1864 and is cultivated as a source of opium in the southern provinces. Fruits of all kinds thrive, but the larger share of attention is given to dates, grapes, oranges, peaches, and apples. Vegetables of all kinds are abundant and the melons of Persia are noted for flavor. Other crops in-

clude sugar cane, almonds, madder, and indigo.

Stock raising is an important source of wealth. Large herds of domestic animals are pastured in the arid regions of the interior, vast tracts of which are suited for grazing. The horse of Persia is held in high esteem both for cavalry and ordinary draft purposes. Sheep and goats are grown on a large scale, the former for wool and the latter for meat and milk. Other animals include cattle, camels, mules, and swine. Fishing is carried on extensively off the shores of the Caspian Sea and the Persian Gulf.

Manufacturing is confined chiefly to artistic fabrics and textiles made of cotton, silk, and wool. Persian carpets are celebrated in the markets of the world and not less than 30 standard varieties are exported. Woolen shawls are made of the hair of goats, the work being done almost entirely by hand. Velvets, embroidery, and silks of fine grade are produced. Considerable quantities of caviar are prepared from the sturgeon, sterlet, and other fishes. Earthenware, rugs, utensils, jewelry, glass, and carvings are made to a considerable extent.

TRANSPORTATION AND COMMERCE. A railroad line is now in operation from Teheran to the Caspian Sea, and this line has been supplemented by the Trans-Persian line finished in 1938. While numerous national highways are maintained, only a few are improved by substantial bridges and extensive grading. A large majority of the inland trade is carried by caravans, for which purpose the camel is used extensively. About 13,500 m. of telegraphs and many lines of telephones are in use.

Tabriz, about 80 m. from the Russian frontier, is the leading commercial center. Teheran has a large inland trade. Bendu Abbas and Bushire, Caspian Sea, are the principal ports. Cotton and on the Persian Gulf, and Meshed-i-Ser, on the woolen fabrics, sugar, breadstuffs, metal wares, and machinery are the principal imports. The exports include raw cotton and wool, rice, fish, fruits, cocoons, gums, opium, tobacco, livestock, and precious stones.

EDUCATION. Education in the country has been greatly improved in recent years. Instruction under the old system was, for the most part, religious. At the Teheran Univ. there are several foreign instructors and native teachers who have studied abroad. All schools are supported by the government except the religious schools, which are kept up by endowments.

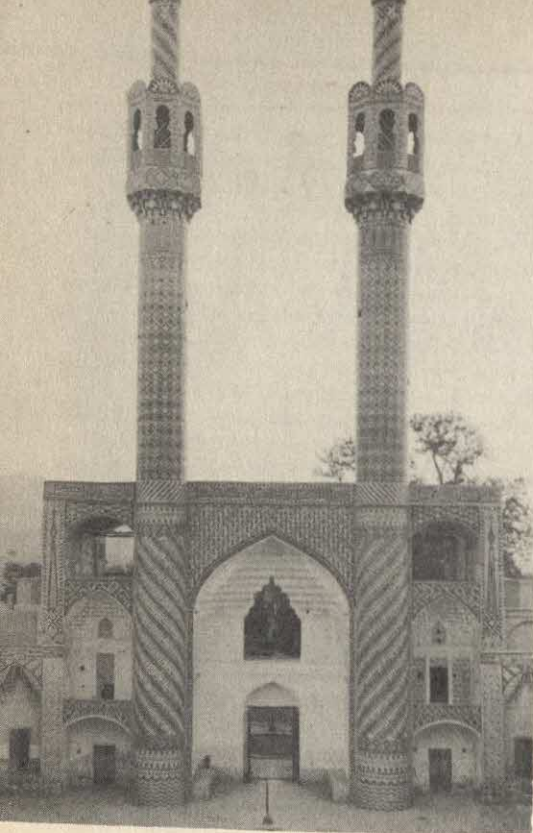
GOVERNMENT. The government is a constitutional monarchy dating from 1906, and the Shah is the chief executive. He is assisted by a ministry of 12 members, who officiate under the direction of a grand vizier. Legislative authority is vested in a senate of 60 and a national council of 156 members. The former are appointed by

the crown and the provinces and the latter are elected by popular suffrage. For the purpose of local government the country is divided into 10 *ustâns*. The Shah holds his office by heredity and has the power to appoint the governors of the provinces. The priests have a large influence in governmental affairs and justice is generally summarily administered. It has a small standing army and a small navy. Revenue is raised principally from the mines, fisheries, customs, and various concessions.

INHABITANTS. A large proportion of the rural population consists of nomadic tribes of Kurds, Turks, Arabs, and Lurs. However, the inhabitants consist chiefly of Iranians, or pure Persians, and the Turkish and Tartaric tribes known as Turanians. The people may be divided into dwellers in villages and towns and dwellers in tents. During the hot summer months many of the richer families take up their residence in the mountains, where they have summer homes. The religion is almost exclusively Mohammedan. Those not Moslem in faith include principally Jews, Armenians, and Nestorians. The percentage of Europeans in the country is small. In 1935, the population was estimated at 15,055,115. Teheran, in the north central part, is the capital. Other cities include Tabriz, Ispahan, Meshed, Kerman, Balfrush, Yezd, Resht, Shiraz, and Kashan.

LANGUAGE AND LITERATURE. Many different but closely related dialects are spoken in Persia. The Iranian language is used most extensively. It includes a number of dialects and is grouped with the Aryan or Indo-European division of languages. The Zend-Avesta, the oldest writing, is the sacred book of the Parsees (*q.v.*) and dates from the time of Zoroaster, though at present only a portion of the original is extant. Other writings include the Gathas, dating probably from the period between 1200 and 1000 B.C., which constitutes a part of the sacred Zoroastrian literature in a language closely allied to the Sanskrit of the Vedas. The language afterward became greatly modified, as is shown by the cuneiform inscriptions on monuments dating from the time of Cyrus. With the Mohammedan conquest other changes in language and literature occurred, but in the 9th century A.D. Persia again rose to importance, and continued as a predominating influence until the Mongols overran the country and destroyed much of its treasures in wealth and literature.

Modern Persia dates practically from the ascent of Ismail Sufi, and since that time the modern Iranian language has been gradually developing. The Arabic characters are used in writing, but four letters have been added. Persian literature is rich in poetry, biography, and history. Rudagi, who flourished about the middle



Courtesy Ewing Galloway, N. Y.

MOSQUE IN EASTERN PERSIA

of the 10th century, is the father of Persian poetry, and Tabari, of about the same period, is the first great historian. Ausari, author of "Mamik and Asra," and Firdusi, author of the national epic, "Shah-Naméh," flourished in the 11th century. Omar Khayyám (died 1123) wrote the celebrated lives of saints, entitled "Pend-Naméh," and the well-known book of poetry, "Rubaiyat." Sadi, the great didactic poet, flourished in the 13th century, and Hafiz, the most captivating of Persian poets, wrote in the 14th century. Ferishtah, who lived in the early part of the 17th century, wrote historical works of great value.

Many of the legends of Persia have been translated into numerous European languages. The Persian drama is the most noted extant in Asiatic countries. Much knowledge of astronomy was obtained from the Arabs, but original works in religion are both numerous and superior. Dictionaries and texts on grammar are abundant, and the country has some excellent and authoritative works on geography and geology. Persia had few great writers after the 18th century. Ferid Ghafer Khan, who enriched literature by collections of Oriental fairy tales, is among the latest of note. Within recent years many translations have been made from European languages.

ART. Persian figurative art—sculpture, painting, and applied arts, especially tiles and rugs—has always had a very distinct character. Originally it developed from Babylonian art and during the flowering of Persian civilization, between the 7th and 3rd centuries B.C., important architecture and relief sculptures were created, especially in Persepolis, whose ruins are still preserved. From the moment the Persians came in contact with Greek civilization, Greek art began to influence Persian artists and when Alexander the Great (*q.v.*) conquered Persia (331 B.C.), he found a style which represented a fusion of characteristic Persian art and Greek influences. Toward the end of the Middle Ages, Persian artists created wonderful miniatures (*q.v.*) and Persian weavers wove rugs which are among the most cherished art treasures of all times, because of the variety of their patterns and the richness of their colors. Equally beautiful were Persian tiles and other kinds of earthenware. The characteristics of Persian style in all its variations through the centuries are a subtle feeling for design and pattern, a strong tendency toward decorative effects, and the ability to convert natural motifs—such as animals and flowers—into sophisticated ornamentation.

HISTORY. The history of Persia begins several thousand years before the Christian era, but the earliest data are wrapped in doubt and tradition. Originally, the country was limited to a small tract along the northern shore of the Persian Gulf. Later it became part of the Assyrian Empire, but in 708 B.C. an empire was established under Dejoces. The sovereigns eventually united in the kindred tribes and subdued all of Assyria. Cyrus, about 558 B.C., rebelled against the Medes and by his successes made the Persians a powerful nation. The boundaries were extended to include Syria, Palestine, Mesopotamia, and Asia Minor, and he became known as the founder of the Persian Empire. His son, Cambyses, succeeded to the throne in 529 B.C., and during his reign of seven years conquered Egypt, Tyre, and Cyprus. Darius I annexed Macedonia, Thrace, and a part of India. Xerxes I became the ruling sovereign in 485 B.C., and was succeeded by Artaxerxes I in 465 B.C., the latter ruling until 425 B.C. Thereafter internal strife began to divide the empire, and in 330 B.C. Alexander the Great, King of Greece, conquered all of the former provinces of Persia and made them a part of Greece.

With the death of Alexander, in 323 B.C., Persia was divided into several provinces, but the greater part was governed by Seleucus, the general of Alexander, and later by his successors, the Seleucidae. Subsequently a long line of dynasties governed the country, during which time it was visited by successive wars that destroyed its former glory and tended greatly to lessen the

population. The Arabians under Caliph Omar conquered Persia in 636 A.D., after which the religion of ancient Persia became supplanted by Mohammedanism. In 1387 Tamerlane conquered Persia with a horde of Mongols and extended his reign from Hindustan to Asia Minor. At his death, in 1405, the country came under the dominion of the Turkomans, who reigned until 1501, when they were succeeded by Ismail Sufi. The latter pretended to be a descendant from Ali, son-in-law of Mohammed, and assumed the title of Shah.

Teheran was made the capital of Persia in 1796, when Futtan Ali removed his residence to that city. This sovereign carried on a disastrous war against Russia and in 1828 was obliged to cede all of Persian Armenia to the Czar. He was succeeded by Mehemet Shah in 1834, whose reign was uneventful, and he died in 1848, when Nasr-ed-Din became the ruling sovereign. In the meantime a dispute arose with the British regarding the sultanate of Herat, which was ceded to the latter in 1857, but subsequently some territory formerly belonging to Oman was annexed. The shah was assassinated at Teheran, in 1896, and Muzaffar-ed-Din was proclaimed the sovereign. He not only reduced the taxes and instituted important reforms, but in 1906 subscribed to a constitution, the first in the history of the country. By this act the nation passed from an absolute to a representative government. On Oct. 31, 1925, the national assembly called *Majlis* (elected every two years) deposed the Shah (king), Sultan Ahmad, and his Kajar dynasty. On Dec. 13, 1925, the assembly elected Riza Khan Pahlevi as Shah of Persia, making the crown of Darius hereditary to his family. For historical developments after 1935, see *Iran*, official name for Persia since that date.

Persian Gulf (*pēr'zhan gulf*), an inlet from the Indian Ocean, situated between Persia and Arabia, and connected with the Arabian Sea by the Strait of Ormuz. It is 575 m. from north to south, and about 185 m. wide. Within the gulf are a number of islands, including Ormuz and the Bahrein Isles. The shores are generally rocky, except in the northern part, where the Euphrates and Tigris enter by a vast delta. Both the fin and pearl fisheries are abundant. The gulf is valuable for navigation. Bushire is the principal seaport. The tide rises 12 ft. at the Strait of Ormuz. In ancient times the Persian Gulf was known as the Sea of Babylon.

Persian Lamb (*lām*), the skin of lambs of the black or caracul sheep. The pelts, used for fur, vary greatly in quality, depending on size, tightness, and luster of the curl.

Persigny (*pēr-sē-nyē'*), JEAN GILBERT VICTOR FIALIN, DUC DE, French statesman, born Jan. 11, 1808; died Jan. 13, 1872. A lifelong supporter

of Louis Napoleon (*q.v.*), he participated in the revolution of 1830 and in a military uprising at Strasbourg in 1836. He was largely responsible for the election of Napoleon as president of the Republic in 1849, and he was one of the prominent leaders of the coup d'état of Dec. 2, 1851. Thereafter he served as minister of the interior (1852), ambassador to London (1855), and again as minister of the interior (1860).

Persimmon (*pēr-sim'mūn*), a tree of the ebony family, sometimes called the *date plum*. It is native to Asia and was introduced to England before 1629. The *American persimmon* is native to the region, extending from Indiana to the Gulf of Mexico. It attains a height of from 25 to 60 ft., and yields a plumlike fruit about an inch in diameter. The fruit is much smaller than that of the species found in Asia. It has from six to eight seeds and is astringent and bitter to the taste until it is made sweet and mellow by frost. The fruit is edible. Tonics and astringents are prepared from the bark of the tree.

Personal Equation (*pēr'sūn-əl ē-kwā'shūn*), in psychology, the influence of the individual personality upon observation. This personal equation differs greatly in different personalities, especially as to visual speed, intensity, and interpretation. A margin for personal equation is usually allowed in scientific observations.

Personality (*pēr-sū-nāl'i-tē*), in psychology, the integral character or individuality of a person; the way in which he tends to act toward others and toward himself. Personality is the sum total of one's physical, mental, and emotional make-up, molded by heredity, environment, and personal experience. Different cultures produce different personality structures. The personality which is most congenial with the total range of institutions within a given culture is known as the basic personality structure. Some important aspects which should be considered in an evaluation of personality are intellectual resources, emotional tendencies and temperament, volitional and action tendencies—interests and strivings, standards and morals, attitude to one's body and the instinctive desires, attitude toward material things, the ability to deal with oneself, social needs and adjustment to the group, and insight concerning the individual's assets and handicaps and his own realization thereof.

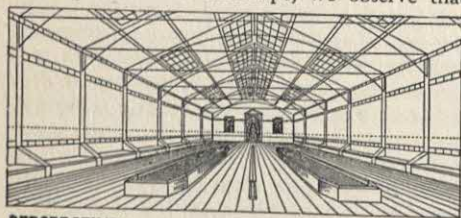
The word *personality* is also often used to signify an individual with one or more outstanding and noteworthy qualities or abilities. See also *Psychiatry*.

Personal Property (*prōp'ēr-tē*), the name applied to every kind of property which is not real estate, such as furniture, jewelry, livestock, money, and stocks and bonds. Title to personal property may be acquired by an agreement between the parties, but the contract need not to

be completed before an officer of the law, as is the case in transferring real estate by deed or otherwise. In some states personal property cannot be held as acquired by purchase, unless the possession passes from the seller to the purchaser. Where the possession does not change hands by reason of a sale, it is often necessary in most cases to have a bill of sale properly acknowledged and recorded.

Perspective (*pēr-spēk'tiv*), the art of representing on a plane surface objects as they appear to the eye from any determinate point of view. All the points of the surface of a body are visible by means of luminous rays which proceed from these points to the eye. As we look out of a window, the glass may be considered the intersecting plane, and, if we draw or paint upon the glass the objects visible through it, we produce in the painting a true perspective. However, only one eye must be used, as each eye, having its own view, sees the objects in a different place on the plane of the glass. Since no objective or pictorial painting can be entirely satisfactory without correctness of perspective, it will be seen that perspective is intimately connected with painting and other arts.

The term *linear perspective* has reference to the effects produced upon the observer by the distance and position of the apparent form and grouping of objects. On the other hand, *aërial perspective* is confined to the distinctness of objects, as modified by light and distance. In the contemplation of a landscape, we observe that



PERSPECTIVE

Interior of a hall, showing important points and lines

the objects nearest to us are most distinct in outline and color, but as they recede from the view the forms become vague and shadowy and the colors lose their intensity and blend together. In painting a picture, therefore, to harmonize with nature, it must not only be drawn true to perspective, but it must also be colored in reference to the proximity of the objects to the spectator. This is termed the art of *aërial perspective*. A projection called *isometrical perspective* has been devised to aid in giving a perspective effect to the drawing of an object and yet enable it to be measured by a scale. Isometry is applied both to mechanical and architectural drawing.

Perth (*pērth*), capital of the State of Western Australia, near the Indian Ocean. It is located

on the Swan River, about 10 m. N.E. of Fremantle, its port, and is on the Eastern Ry. The surrounding country is mining and agricultural. Among the principal buildings are the governor's palace, the city hall, the Parliament House, an observatory, and several schools and churches. Clothing, tobacco products, machinery, earthenware, and canned fruits are among the manufactures. The place was laid out and incorporated as a city in 1856. Population, *ca.* 197,000.

Perth, a city in Scotland, capital of a county of the same name, on the Tay River, 42 m. N.W. of Edinburgh. The Tay is crossed by a fine bridge of nine arches, 880 ft. long. Perth has a beautiful site on the banks of the river, where the scenery is beautified by the Grampians and by excellent forests and parks. It has extensive railroad connections, and street railways. Among the manufactures are liquors, machinery, textiles, dyes, and utensils. The salmon fisheries of the Tay are valuable and much of the product is canned here. The city has a number of fine buildings, including the Church of St. John, the King James VI Hospital, a penitentiary, the public library, the central railway station, and a number of educational institutions. It is thought that Perth was founded by the Romans. It was the capital of Scotland until 1437. Population, over 36,000.

Perth Amboy (*ām'boi*), a city and port of entry in Middlesex County, New Jersey, on the Raritan River and Bay, 21 m. S.W. of New York City. It is on the Pennsylvania, the Lehigh Valley, the Central of New Jersey, and other railroads, and on interurban bus lines. In the vicinity are valuable deposits of kaolin and fire clay. The chief buildings include the public library, the high school, and the town hall. Among the manufactures are terra cotta, cork, copper, chemicals, tobacco products, oil, and textiles. The city has a large trade in cereals and merchandise. It was settled by Scots in 1683, and it was incorporated as a city in 1784. Population, 1950, 41,330.

Perthshire (*pērth'shēr*), an inland county of Scotland, area 2,493 sq. m.; capital, Perth. The Tay, flowing 117 m. through the county to the North Sea, is Scotland's longest river. Sir Walter Scott's "Lady of the Lake" immortalized the region. The Blackfaced breed of Perthshire sheep are famous. Wildlife is abundant; dyeing and bleaching, flax, jute, cotton, linen, woollens, and tartans are the chief industries. In 83 A.D. the Romans under Agricola penetrated the region. In 1054 Macbeth was defeated at Dunsinane, and Robert Bruce was defeated at Methven in 1306. The Battle of Killiecrankie took place in the county in 1689. Population, *ca.* 120,000.

Pertinax (*pēr'ti-nāk's*), PUBLIUS HELVIUS, Roman emperor, born in 126 A.D., the son of a charcoal burner. From being a grammar teacher, he rose to consul, and was elected (Jan. 1, 193),

PERTURBATION

against his will, to succeed Commodus as emperor. On Mar. 28, 193, he was assassinated in a mutiny of troops.

André Géraud, a contemporary French journalist and author of articles and books on current politics, has used the name as a pseudonym.

Perturbation (*pěr-tūr-bā'shūn*), in astronomy, a disturbance in the movement of the planets or other celestial bodies, causing them to deviate from their elliptic orbit. These movements are due to the attraction of other planets upon a heavenly body. According to Kepler's laws, if a planet were attracted by no body except the sun, it would describe an ellipse, with the sun in one of the foci, but other planets in the solar system cause it to deviate from such an ellipse. Perturbations are either *periodic* or *secular*, the former of which compensate each other, while the latter are changes in the form of the orbit which go on in the same direction from time to time.

Peru (*pě-rōō'*), a city in La Salle County, Illinois, on the Illinois River, 98 m. s.w. of Chicago. It is near the Illinois & Michigan Canal and on the Chicago, Rock Island & Pacific and the Chicago, Burlington & Quincy R.R.'s. The surrounding country is agricultural, producing cereals and dairy products, and contains extensive deposits of bituminous coal. It has several fine churches and a public park. The chief buildings include the Turner Hall, the Masonic Temple, and the high school. Among the manufactures are zinc, flour, hardware, machinery, brick, clocks, and farming implements. It has a flourishing trade in merchandise. Peru was settled in 1827 and chartered as a city in 1852. Population, 1940, 8,983; in 1950, 13,308.

Peru, county seat of Miami County, Indiana, on the Wabash River, 75 m. N. of Indianapolis. It is on the Wabash, the Nickel Plate, and the Chesapeake & Ohio R.R.'s. It is surrounded by a rich farming and dairying country. Among the manufactures are heating equipment, boilers, furniture, novelties, processed foods, and household appliances. The city boasts one of the finest municipal golf courses in the Middle West. It was incorporated in 1848. Population, 1950, 8,653.

Peru, a country of South America, one of the five republics that border on the Pacific Ocean. It is bounded on the north by Ecuador, east by Brazil and Bolivia, south by Chile and the Pacific, and west by the Pacific. The length from north to south, measured along the coast, is 1,100 m. and the greatest breadth is 800 m. It has a total area of 482,258 sq. m.

DESCRIPTION. The surface varies greatly in its composition and elevation above sea level. A narrow coast plain lies along the Pacific and about 60 m. inland the Andes Mts. run almost parallel

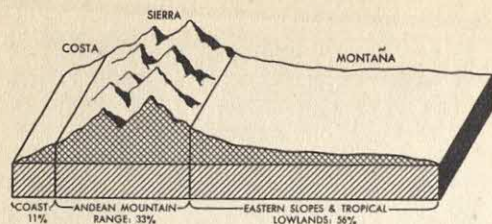


Courtesy Pan-American Union, Wash., D. C.

PERUVIAN INDIANS

to it. This coast region is largely a sandy desert, ranging in width from 20 to 120 m., and rises gradually to form the foothills of the Andes. The Andes are about 250 m. wide and are characterized by many lofty summits, among which stretch elevated plains and tablelands. These highlands are in two chains, or cordilleras, many of which are volcanic and contain thermal springs. Fully two-fifths of the surface of Peru is occupied by the highlands and mountains. They reach summits of from 14,000 to about 20,000 ft., including Cotopaxi and Chimborazo, with elevations of 19,613 and 20,498 ft., respectively. In the eastern part stretches a vast region included in the Amazon basin, through which many streams flow eastward. The Amazon basin in Peru is known as *Montaña*, or *Los Bosques*, and abounds in dense forests and other forms of luxurious vegetation.

The drainage belongs to two systems, that of the Pacific slope and that of the Amazon. All of the streams on the Pacific slope are short and unimportant and many are lost in the desert sands. A few streams, such as the Santa River, carry a small quantity of water during the dry season, but at the time of heavy rains become great torrents. The rivers east of the Andes include the Amazon, the upper course of which is called the *Maramón*, the *Ucayale*, the *Javari*, and the *Juruá*. Of these the Amazon is the most important, being navigable from Iquitos, in eastern Peru, to the Atlantic. Several beautiful lakes are in the mountain regions, including *Junín* and *Titicaca*, which are valuable for their fisheries. The latter lies 12,500 ft. above sea level. It is the



Courtesy Office of Inter-American Affairs, Wash., D. C.

PHYSICAL FEATURES OF PERU

most important inland lake of South America and belongs partly to Bolivia.

The rainfall is greatly diversified, owing to the varying effects of the altitude and the trade winds. On the coast region rain seldom falls, because the trade winds, passing across the continent from the Atlantic, exhaust their supply of moisture in sweeping over the Cordilleras. Hence that region is dry and arid, and the rivers, fed partly by springs and mountain snow, are practically the only source of water for irrigating cotton and sugar plantations. At Lima, on the coast, not more than one or two inches of rain fall during the year. In the mountains and the Amazon basin rainfall is abundant. The climate of the coast is hot, but is somewhat modified by the winds blowing from the snow-capped Andes and by cold oceanic currents. January and February are the hottest months, when the mean temperature on the coast is 84°, but maximums of 98° and even 105° are reached. In all parts of Peru the climate is exceptionally healthful.

MINING. The country is rich in minerals, copper and petroleum being chiefly exploited. The annual production figure for copper is about 40,000 metric tons, and for petroleum, about 1,600,000 metric tons. Peru produces much of the world's supply of vanadium. Gold is found, but mining is not prominent because of transportation and labor difficulties. There are large unworked iron deposits, and at Marcona, the government-owned field has about 500,000,000 tons. Other minerals to be found include silver, lead, tungsten, and coal.

AGRICULTURE. Farming is developed most extensively in the fertile coast valleys, and about 80 per cent of the population depends on agriculture for a living. Sugar is grown in the irrigated river valleys of the coast region. The districts of Chanchamayo, Perene, and Paucartambo in Central Peru constitute the principal coffee-growing centers. Other important products are cotton, wool, hides and skins.

The livestock industry, though not developed as extensively as the resources permit, has flourished chiefly in the eastern part, where large areas have nutritious grasses. Sheep are grown extensively for wool, but this product is obtained also from the alpaca and the llama. Poultry raising has received much attention and the grades are superior, but cattle and horses are not well bred. Goats, swine, and mules are grown to some

PERU

extent. An extensive and remarkable fauna still exists in Peru and includes the tapir, vicuna, sloth, armadillo, alligator, guanaco, monkey, and boa constrictor. Many beautiful birds of song and plumage abound. The larger species of birds include the toucan, hawk, buzzard, pheasant, and condor.

MANUFACTURES. Comparatively little has been done to develop manufacturing, but foreign capital is promoting many lines that furnish commodities for exportation. Cotton is the most important crop and agricultural export. Sugar is one of the leading products and is made almost exclusively from home-grown sugar cane. Several large establishments prepare rice for market, and considerable interests are vested in the manufacture of wine from native-grown grapes. Smelting is an important enterprise in connection with the mines. Pipe tobacco, cigars, malt and distilled liquors, furniture, clothing, and textiles are made chiefly for home consumption. Fine straw hats are made in large quantities, which are sold in the trade as *Panama* hats. Although large quantities of petroleum are produced, much of it is exported in an unrefined state. In recent years, however, oil processing has grown in importance. Other manufactures include boots and shoes, soap, olive oil, cottonseed oil, and canned fruits.

TRANSPORTATION AND COMMERCE. The Amazon is the only navigable river and steamers ascend regularly as far as Iquitos. Callao, the port of Lima, has a large coastwise trade and steamboat connections with the principal ports of Europe and America. Railway building is encouraged by the government and the lines in operation have a length of 2,800 m., but much of the railway mileage is narrow gauge. The principal lines connect the coast with interior points, but few branches are maintained. In 1937 the government launched a three-year program to construct new roads into the mountain regions, improve existing roads, continue the Pan-American Highway along the coast, and complete a long highway from Huanuco to the Bolivian border. The telegraph lines include about 12,000 m. Railway and highway construction is extremely difficult in the mountainous regions, owing to their vast elevation and the rocky and craggy character, thus requiring great engineering skill and enormous expense.

The exports exceed the imports, the former having an average annual value of about 400,000,000, and the latter about \$300,000,000. The principal exports in order of their importance are petroleum and derivatives, cotton, copper bars, sugar, wool, mineral concentrates, precious metals, and hides; the principal imports are colors and dyes, textiles, machinery and vehicles, metals and jewels, foodstuffs, pharmaceuticals, cotton and woolen goods, and electrical supplies.

GOVERNMENT. The present constitution was revised in 1933 and again in 1936 and 1938. It vests the executive power in a president, who is elected by popular suffrage for six years. He is assisted by a cabinet of nine ministers, who hold office at his pleasure, but his acts are subject to their approval. The legislative authority is vested in a senate of 48 members, and a chamber of deputies of 140 members. A supreme court of justice has final jurisdiction and is composed of judges elected by the congress from a panel presented by the president. Peru is divided into 23 departments and several islands. Each department has superior courts. Local government is administered in departments and districts, the chief officers of which are appointed by the president or by prefects, respectively.

EDUCATION AND RELIGION. Education is compulsory between the ages of 7 and 14. Both primary and secondary school education is free. A system of high schools is maintained under national laws. A number of normal schools provides training for teachers, and commercial and industrial schools provide additional training opportunities. San Marcos is the seat of the national university, which has an attendance of over 2,000 students and maintains faculties of medicine, law, literature, theology, and political science. Other universities are maintained at Cuzco and Arequipa, and several botanical and zoological gardens are supported at Lima. Equal political and religious freedom are guaranteed under the constitution, but Roman Catholicism is the prevailing religion.

INHABITANTS. The native population, consisting chiefly of Peruvian Indians, comprises more than half of the inhabitants. About one-fourth are of mixed blood (*mestizos*) and the remainder are chiefly Spaniards or of Spanish descent. Although Spanish is the national language, the Peruvian dialect is still spoken by a majority of the people. The population is quite stationary, showing only a slight increase from time to time, and immigration from Europe is very small. Lima, the capital, is the largest city. Other cities include Cuzco, Arequipa, Callao, Concepcion, Catacaos, Iquitos, and Truxillo. Population, 1940, 7,023,111.

HISTORY. Little is known of the ancient history and civilization of Peru. Writers generally divide its history into three periods: the Pre-Incarial, the Incas, and the Spanish periods. The Pre-Incarial period includes a time of unknown duration, when the region was populated by a people who were highly advanced in language and civilization and built vast cities. Traces of this period are abundant near Lake Titicaca and elsewhere, and occur in the form of sculptures, pillars, immense masses of hewn stone, ornaments, and fragments of buildings. Nothing is

known of the origin of the Incas, but they are thought to have been less advanced in civilized arts than the people who preceded them. However, when the Spanish invaders conquered the region, their cities and industrial arts had reached a high development. Pizarro with a band of Spanish adventures invaded Peru in 1532 and before the end of the year captured Atahualpa, the Inca sovereign, and deprived him of his power.

From the conquest by Pizarro until 1821 Peru was a Spanish possession, but in that year independence was proclaimed. However, Spanish dominion did not terminate until 1824, when a prolonged war ended favorably to the revolutionists. A constitution was adopted soon after, which was supplanted by the constitution of 1856 and several amendments. Peru and Bolivia formed an alliance against Chile in 1879, which resulted in the success of the latter, and accordingly Peru ceded by treaty, in 1883, the province of Tarapaca to Chile. This cession was a heavy loss, because the province contains vast deposits of nitrates and numerous other valuable minerals. During World War I, Peru severed diplomatic relations with Germany in 1917, but did not declare war. Peru's history for many years has been replete with boundary disputes, involving her frontiers bordering on Chile, Bolivia, Colombia, and Ecuador. In spite of unrest and, in some instances, seizure of border towns, such as Leticia, Colombia (by Peru, 1932), the various disputes were finally settled amicably by agreements, arbitration, or treaties. The common boundary between Peru and Brazil was demarcated by a joint commission in 1927, in a decision favorable chiefly to Peru. In the settlement (Lima, Peru, 1929) with Chile, the province of Tacna was assigned to Peru, while Chile gained Arica. A joint committee fixed the frontier line between Peru and Bolivia. The border dispute of 120 years' standing with Ecuador was settled by agreements signed by the two countries in 1945. The Colombian quarrel, first settled by the Salomon-Lozano Treaty (1928), flared up again in 1932, when the League of Nations took over the administration of the town of Leticia until negotiations suitable to both countries were finally held in Bogotá in 1935.

During World War II, Peru renounced all diplomatic relations with the Axis Powers on Jan. 24, 1942. She declared war on Germany and Japan on Feb. 12, 1945, and joined the United Nations on February 14. On April 30, 1948, Peru signed the charter of the Organization of the American States.

See also *Pan American Union*.

Perugia (*pâ-rōō'jâ*), a city of Italy, on the Tiber River, 10 m. E. of Lake Perugia and 83 m. N. of Rome. It is the capital of the province of Perugia, which is highly fertile. The city is sur-

rounded by fortifications and contains a number of massive buildings, including a Gothic cathedral built in the 15th century. The Univ. of Perugia was founded in 1276. This institution has a fine museum, carries advanced courses of study, and has a large library. Other noteworthy structures are the public library, and the Roman Arch of Augustus. Among the manufactures are silk and woolen goods, velvets, liquors, soap, utensils, and machinery. Perugia was anciently an Etrurian republic, but in 294 B.C. it became a part of Rome. It was annexed to Italy by Victor Emmanuel in 1860. Population, *ca.* 80,000.

Perugino (*pā-rōō-jē'nō*), PIETRO VANNUCCI, Italian painter, born in Umbria, about 1446; died near Perugia in December 1523. He first studied



PIETRO PERUGINO

Self-portrait

at Perugia, from which city he received his name, and later he was instructed in Florence under Andrea Verrocchio. About 1480 he established himself at Rome, where he was employed by Pope Sixtus IV to decorate with frescoes the Sistine Chapel. His fresco entitled "Christ Giving the Keys to Peter" is one of the finest in that building. Other famous works are still preserved in a number of European galleries. Raphael was for a time a student of Perugino.

Peruvian Bark (*pē-rōō'vī-an bārĕ*), a valuable product of several species of trees belonging to the genus *Cinchona*. The trees that yield this product are native to Peru and other countries of South America. Peruvian bark is known in some countries as *cinchona bark*, *china bark*, and *Jes-*

uits' bark, the last-mentioned name being from the Jesuits, who introduced it into Europe. This product is valuable as the source of *quinine*, which is extracted and sold extensively for medical purposes. It also yields *cinchonine*, an alkaloid occurring with quinine in the bark, but it is less powerful than quinine.

Pescadores (*pēs-kā-dō'rēs*), a group of 48 islands with an area of 49 sq. m., lying 30 m. w. of Formosa (Taiwan) in the Pescadores or Taiwan Strait. They are known in Japanese as Bōkotō, and were ceded by China to Japan in 1895. Mako is the principal port, and fishing the chief industry. At the end of World War II, the islands were restored to China. During the Chinese civil war they remained in Nationalist hands. In 1955 the U.S. was committed to their defense. Population (mainly Chinese), *ca.* 70,000.

Peshawar (*pā-shā'wūr*), or PESHAWR, a city of Pakistan, capital of the North-West Frontier Province, 12 m. E. of the Khyber Pass. It is located on the Kabul River. The chief buildings include a mission school, the government house, and a number of Christian churches. It is a military station and has railway connections with the leading cities of the Indian sub-continent. It is the terminal of a highway from Kabul, Afghanistan. The trade is chiefly in carpets, livestock, and cereals. The city has manufactures of cotton and woolen textiles, pottery, and machinery. A large majority of the inhabitants are Moslems. Population, 1951, 151,776.

Peso (*pā'sō*), a coin used in the monetary systems of Spain and several Latin-American countries. See *Coin*.

Pessimism (*pēs'i-mīz'm*), a belief that the amount of evil in life surmounts the amount of good; consequently the least favorable course of events among all possible courses will inevitably occur and the amount of pain in life will always be greater than the amount of pleasure. This attitude has found its way into the teachings of some philosophers and of certain religions.

The psychological explanation of pessimism as a human emotional attitude is that it is based on certain neurotic tendencies in man or on unfavorable physiological, economic, or social conditions. People suffering from unfavorable circumstances, quite naturally, seldom have the emotional balance not to identify their special conditions with the general state of the world. Personal inhibitions, lack of individual certainty, and frustrations may lead to the same attitude. The emotional attitude of pessimism, however, has nothing to do with philosophical pessimism. It is perfectly possible for a philosopher to adhere to extreme pessimism in his teachings and nevertheless to lead an emotionally balanced life and have a perfectly self-assured and happy temperament.

In Christian thought, pessimism concerns only this life. The idea of final redemption and the expectation of salvation are essentially optimistic; thus the believing Christian can be pessimistic only in regard to happenings of this world. The pessimistic trend is more outspoken in Calvinistic and Puritan thought than in that of the Roman Catholic Church. Other religions take other views. Buddhism, for example, is actually entirely pessimistic, since its concept of the world identifies all happiness and all actions as evil and sees as the final goal for the Buddhist only the complete absorption into nirvana, rather than any state of eternal bliss. Even the ancient Greeks in their religious belief doubted the reality of absolute knowledge and absolute good, and considered Hades as a place of eternal despair. The Jewish concept of Sheol (*q.v.*) likewise does not leave any possibility for optimistic hope.

Philosophically, pessimism was first formulated as a doctrine by ancient philosophers. The idea was most clearly outlined by Epicurus (*q.v.*). He taught that happiness can be achieved only by the absence of pain, clearly a very modest and relative conception of happiness, since he considered it nothing positive but only the denial of something negative. Medieval and post-medieval philosophers were too much influenced by the teaching of the Church to develop any ideas about pessimism besides those found in Christian concepts. To the philosophers of the Enlightenment (*q.v.*), pessimism expressed itself mainly in their theory of history. Many of them, but especially Rousseau (*q.v.*), looked at the development of human society as a continuous process of degeneration from its original state of natural purity. Rousseau, however, left some hope that affairs would take a better turn when he wrote about the possibilities of new historical beginnings through a political change in society.

Arthur Schopenhauer (*q.v.*) is the most outspoken philosopher of pessimism. His concept in "The World as Will and Idea" is completely deterministic (see *Determinism*) and therefore pessimistic. He explains the world itself as the result of *willing*, defining willing as desiring ends which can never be fulfilled and are unattainable. Thus, according to him, satisfaction logically can never be achieved. His philosophy was of great influence not only on later philosophers but also on the whole literature of the 19th century. The most outspoken pessimistic philosophers after him were Eduard von Hartman (1842-1906), who differs in his system from Schopenhauer but arrives at similar pessimistic conclusions, and Oswald Spengler (*q.v.*), who looked at history as a continuous story of deterioration and believed that our civilization is bound for final and unavoidable catastrophe.

Pestalozzi (*pēs-tā-lōt'sē*), JOHANN HEINRICH,



Courtesy Swiss Federal Railroad

HEINRICH PESTALOZZI

educational reformer, born in Zurich, Switzerland, Jan. 12, 1746; died in Brugg, Feb. 17, 1827. Educated for the ministry by his grandfather, he first entered this profession but soon took up the study of law. After a short time, he abandoned this career as well, turning his attention to his guiding interests, agricultural life, and the bettering of educational and social conditions of poor children. Around 1775, he gathered some destitute children and opened for them a settlement at Neuhof, Aargau, Switzerland, which, however, he was obliged to close in 1780. These years of practical experiences were crystallized in his early publications, "Evening Hours of a Hermit," his main work (1781). Under the patronage of the Swiss government he established an experimental school at Berthous, and during that period wrote "How Gertrude Teaches Her Children" (1801), the most important expression of the pedagogical theories which he termed "psychological education." His central conception was that general social reform must grow out of the moral and intellectual development of the individual child. In 1799 he had established a school in Burgdorf, which was moved in 1805 to Yverdon. Here, for 20 years, the school spread Pestalozzi's reputation and proved the value of his ideas. Largely influenced by the work "Émile" of the French reformer Jean-Jacques Rousseau (*q.v.*), Pestalozzi laid the foundation for modern elementary school systems in both Europe and America.

Pest (*pĕst*). See *Budapest*.

Pétain (*pā-tān'*), HENRI PHILIPPE, French general, born at Cauchy le Tour, Pas-de-Calais, France, May 24, 1856; died on the Ile d'Yeu, July 23, 1951. Pétain began World War I as a division general, and after a successful offensive at Artois (1915) he commanded the defense of Verdun (1916). In 1918 he became commander in

chief of the French armies under Marshal Foch and was later himself named a marshal of France. After the war he became vice president of the Higher Council of War (1920-30), inspector general of the French army (1922), and commander of the French forces putting down the Moroccan revolt (1925-26). He subsequently held various cabinet and government posts. After the fall of France in World War II, he made himself chief of state and formed an authoritarian government at Vichy. He fled France in 1944, when the Allies retook the country, but returned in May 1945. He was sentenced to death for intelligence with the enemy, but his penalty was commuted to life imprisonment. See also *France; Laval, Pierre*.

Petaluma (pēt-q-lōō'mq), a city in central California on Petaluma Creek, in Sonoma County, 35 m. N. of San Francisco. It is on the Northwestern Pacific R.R. Located in a fruit and poultry district, it has some manufacturing interests (value added by manufacture, 1958, \$1,929,000). The Two Rock Ranch Station (Army) is located there. Petaluma was founded in 1852 and incorporated as a city in 1884. Population, 1940, 8,034; in 1960, 14,035.

Petén (pā-tān'), a department in northern Guatemala. Most of it is a dense jungle area and relatively undeveloped. It produces cacao, chicle, rubber, mahogany, and dyewoods. Its capital is Flores, which was once a center of the ancient Mayan culture. Area, 13,843 sq. m.; population, 1950, 15,908.

Peter (pē'tēr), SAINT, originally SIMON, sometimes SIMON PETER, the first apostle of Jesus, the son of Jonas and the brother of the apostle Andrew. He was a fisherman, as were his father and brother. Jesus called them to become "fishers of men" as His disciples. Peter became the closest to Christ of all His apostles. Christ lived in Peter's house at Capernaum with him, and most happenings spoken of in the New Testament are connected with Peter.

Peter's character is, in its inconsistencies, typically human, sometimes courageous, sometimes timid. Peter the courageous was the one disciple who tried to defend Jesus after His arrest; Peter, the timid, was the one who denied Christ before the cock's crow. And yet Jesus gave him the name Cephas, meaning a rock, and it is from a Greek translation of the same word, *petra*, rocklike, that he has become known as Peter. He was the one who was called by Jesus, as the first of His disciples, to preach first among the Jews and then to the whole world. And unlike the other apostles, he was not given a special training by Christ for this mission, but was simply allowed to be present when Christ taught the people or disputed with His adversaries. Faith in the Messianic nature of Christ was not only strong in Peter

(as in the other apostles), but he was the first in whom it arose. Like the others, he did not fully understand at first the nature of Christ's mission and conceived of His being the Messiah in too narrow a sense. In spite of all these shortcomings, however, Christ appointed him as His vicar on earth, and therefore the see of the Pope calls itself "apostolic" (see *Keys, Power of the*).

The question whether the two letters of Peter incorporated in the New Testament are original or apocryphal has been a topic of much scholarly discussion. In any case, it was his leadership which inspired the first church in Jerusalem, and he was the one who had the first vision of the risen Lord. After having preached in Cappadocia, Pontus, Antioch, Corinth, Galatia, Bithynia, and Rome (especially to Jews, while Paul became the special teacher of the Gentiles), he finally became the first bishop of Rome, which he had previously visited in A.D. 43. He was martyred there in A.D. 64 or 66 on the Vatican hill. Legend tells that he wanted to be crucified with his head downward because he was too modest to die in the same way as Christ had suffered His death. In 1950 Pope Pius XII announced that the long-sought burial place of St. Peter had been found, beneath St. Peter's Basilica in Rome.

Peter I, ALEKSEEVICH, called PETER THE GREAT, emperor of Russia, born in Moscow, June 9, 1672; died in St. Petersburg (Leningrad), Feb. 8, 1725. He was the son of Czar Alexis Mikhailovich, who died in 1676. The throne was left to Fëdor, half brother of Peter. Fëdor died in 1682 without issue, and on his death, two opposing factions arose. The relatives of Peter's mother, who had been Alexis' second wife, supported Peter as Fëdor's successor, but the relatives of Alexis' first wife led a revolt in favor of Ivan, Peter's half brother, who was weak-minded. The latter

PETER I



group was led chiefly by Ivan's older sister, the Grand Duchess Sophia (*q.v.*), and gained the upper hand. Finally both boys were crowned co-czars, with Sophia as regent.

Peter and his mother lived in a village near Moscow during Sophia's rule. Peter was left to his own devices and spent his time sailing and having sham fights with his friends. He learned some rudiments of geometry and fortification and became very much interested in shipbuilding. In 1689 Peter's faction learned that Sophia was planning an attempt against Peter's life. They led a revolt, and Sophia was deposed and confined to a convent.

From then on, Peter was virtually the sole czar, and in 1696 Ivan died, leaving him the only ruler. Peter immediately began to plan the development of Muscovite power. He reorganized and disciplined the army, invited engineers and architects from abroad to aid in the construction of highways and public buildings, and personally visited The Netherlands to become acquainted with naval arts. The greater part of his time in 1697-98 was spent in the shipyards of Holland and England, that he might become acquainted with all the intricacies of shipbuilding and navigation. In the meantime he provided funds from the public revenue to enable young men to travel in foreign countries for the purpose of coming in touch with agricultural arts, stock-raising, manufacturing, commercial enterprises, road and canal building, and the planning of cities. Some of these young men studied military arts in Germany, others philosophy, astronomy, surgery, geography, anatomy, metallurgy, and commerce in the higher institutions of different countries. William III invited Peter to visit England, where he mingled freely with artisans and laborers and received a degree from Oxford Univ. Returning to Russia, he waged war (1701-21) against Charles XII of Sweden, to gain the Baltic provinces. He created a navy, built seaports, and constructed vast canal systems. He reformed dress and manners and founded schools. To promote improvements in these lines he invited foreign teachers and artisans of all kinds to his dominion.

Peter laid the foundation of St. Petersburg on May 27, 1703. On July 8, 1709, he gained the battle of Poltava against the military forces of Sweden and the following year annexed a part of Finland. He married Catherine (*q.v.*) in 1712, in St. Petersburg, and the same year the capital was moved to that city from Moscow. He made an extended visit to European countries in 1716-17 in company with the czarina and made plans to establish an academy of sciences (founded in 1726). Peter was ever zealous in carrying forward improvements but became greatly enraged by the least opposition. His son, Alexis, became implicated in a scheme to oppose some of the re-

formatory plans. He was tried on a charge of treason and condemned to be executed but died from shock and the effects of torture before the time set for the execution.

In 1722 Russia declared war against Persia for the purpose of opening the Caspian Sea to commerce, which resulted in the annexation of the cities of Baku and Derbent and three provinces to Russia. In the same year Peter established the law of sovereign succession, by which the czarina became recognized as the heir apparent to the throne. His empress was crowned as Catherine I shortly after his death.

Peter II, ALEKSEEVICH, emperor of Russia, grandson of Peter the Great, born in St. Petersburg, Oct. 23, 1715; died there, Jan. 9, 1730. He was the son of Alexis, Peter the Great's son by his first wife. Catherine I died May 17, 1727, and Peter II was crowned in accordance with Catherine's will. He caught smallpox about two years after his coronation and died soon after. He was succeeded by Anna, the daughter of Ivan, half brother of Peter the Great.

Peter III, FEDOROVICH, emperor of Russia, grandson of Peter the Great, born in Kiel, Germany, Feb. 21, 1728; assassinated in Ropsha, Russia, July 17, 1762. He was the son of Anna Petrovna, eldest daughter of Peter the Great, and was declared the successor to the throne of Russia by Czarina Elizabeth in 1742. Immediately he took up his residence at the Russian court and married the German princess, Sophia Augusta, who assumed the name of Catherine Alexiwna. On the death of Elizabeth, in 1762, he succeeded to the throne. He withdrew from the alliance made by Russia, Austria, and France against Prussia, and sent an army of 15,000 men to aid Frederick II of Prussia. Soon he recalled many of the Siberian exiles. He next formulated a plan to obtain Schleswig from Denmark, but before the design could be carried out a conspiracy against him was planned by his wife, with whom he had quarreled a great deal and whom he was thinking of divorcing. Peter showed a remarkable want of energy in suppressing the insurrection and took decisive measures only when it was too late. The conspirators removed him to Ropsha, where he was forced to abdicate and was afterward strangled by Gregory Orloff, one of the conspirators. His wife succeeded him as Catherine II (*q.v.*).

Peter I, king of Serbia (now part of Yugoslavia), born in Belgrade, Serbia, June 29, 1844; died there, Aug. 16, 1921. His grandfather led an army of Serbians against the Turks, who recognized him as prince of Serbia in 1812. His father, Alexander, was elected prince of Serbia in 1842. The son was educated in Hungary and France, and during the Franco-Prussian War he served in the army of France. In 1877 he sided with Russia

in the war against Turkey and the following year Serbia became independent. Subsequently he lived in Switzerland. When King Alexander of Serbia was assassinated, in 1903, Peter was proclaimed king by his father's murderers. He entered Belgrade in June of that year, after an absence of 44 years. Despite Russian influence on his foreign policy, as a ruler Peter promoted Serbian national interests and strongly opposed the annexation of Bosnia and Herzegovina by Austria-Hungary (1908). When the Central Powers overran Serbia in 1914, Peter was expelled from the country. He died seven years later.

Peter II, former King of Yugoslavia, born Sept. 6, 1923. Son of King Alexander I, he was educated in England, ascended the throne in October 1934 and governed under a regency of his uncle Prince Paul, up to 1941, when, after the *coup d'état* which made him a member of the Allies, he acquired full sovereignty. After the occupation of Yugoslavia through the Germans (1941), he left for London and established there a government-in-exile. On Jan. 29, 1945, however, he agreed to a formation of a regency under Marshal Tito, which was in actual fact the abdication of the monarchy. Six months later, while still in London, he disavowed the Tito regime; but by that time the new regime was almost fully established, and in December 1945, Britain and the U.S. announced their recognition of the Tito government.

Peter Ibbetson (*pě'tēr ib'it-sūn*), a novel by George du Maurier (1834-96) which served as the libretto of an opera by Deems Taylor (*q.v.*).

Peterkin (*pě'tēr-kin*), JULIA (née MOOD), novelist, born in Laurens County, S.C., Oct. 31, 1880; died in Orangeburg, S.C., Aug. 10, 1961. She was graduated (1896) from Converse Coll. and married (1903) William G. Peterkin, owner of Lang Syne Plantation, Ft. Motte, S.C. From workers on the plantation she gained a close knowledge of Gullah dialect, spoken by long-isolated Negroes of almost pure African descent. With this background, she wrote "Scarlet Sister Mary" (1928, Pulitzer Prize 1929). Her other novels include "Green Thursday" (1924), "Black April" (1927), and "Plantation Christmas" (1934).

Peter Pan (*pān*), a dramatic fairy fantasy by the English playwright and novelist Sir James M. Barrie (1860-1937), produced for the first time in London in 1904, where it has since been performed each Christmas season. The American premiere took place in New York City a year later with Maude Adams in the title role. Barrie's novels, "Peter Pan in Kensington Gardens" and "Peter and Wendy," are sequels to the drama. The character of Peter Pan, the boy who never grows up, has become part of English folk literature.

Peter the Cruel (*křōō'ēl*). See *Pedro the Cruel*.

Peter the Hermit (*hēr'mit*), apostle of the First Crusade, born at Amiens, France, about 1050; died at the monastery of Huy, in the diocese of Liège, July 7, 1115. Nothing is certain about his early life, although he is sometimes said to have spent some time in the army and to have married, becoming a monk after his wife's death. It is possible, although uncertain, that he made a pilgrimage to Jerusalem, or at least to Palestine, after 1090. It is not even certain that he was present at the Council of Clermont in 1095, when Pope Urban II urged the reconquest of Jerusalem. At any rate, immediately after the Council he began preaching in France, eventually amassing an army of 30,000 followers. Starting from Cologne, he and his band began the march to Constantinople known as the Peasants' Crusade, one of the first sections of the First Crusade. After a terrible journey through Germany, Hungary, and Bulgaria, during which his ranks were badly decimated, he arrived at Constantinople. There, despite help from the Byzantine emperor, Alexius, his army was almost completely demolished by the Turks. In 1097, gathering together the few followers who remained, he joined the main branch of the First Crusade under Godfrey of Bouillon, and after this time his part in the Crusade is of minor importance only. Godfrey's forces finally captured Jerusalem in 1099 and Peter preached to the victorious army from the Mount of Olives. Soon after, he returned to Europe and founded the monastery at Huy, of which he was the first prior.

The widely believed story which credits Peter with being the originator of the First Crusade was told by William, Archbishop of Tyre (*ca.* 1130-90), and was accepted by scholars and church historians for many centuries, but it has been generally discredited in modern times.

Peters (*pě'tērz*), CHRISTIAN HENRY FREDERICK, astronomer, born in Schleswig, Germany, Sept. 19, 1813; died in Clinton, N.Y., July 19, 1890. He studied at the Univ. of Berlin and, after spending several years in foreign travel, located in the U.S., receiving a position on the government coast survey. In 1858 he became professor of astronomy at Hamilton Coll. and at the same time was director of the Litchfield Observatory, at Clinton, N.Y. He was selected to conduct a party to New Zealand in 1874 to observe the transit of Venus. During his service as director the Litchfield Observatory was greatly improved and he added materially to its equipment. He recorded 20,000 spots on the sun, discovered a large number of asteroids, and investigated the orbit and nature of many comets. The catalogue prepared by him contains 16,000 zodiacal stars.

Peters, CARL, explorer, born in Neuhaus, Germany, Sept. 27, 1856; died in Woltorf, Sept. 10, 1918. Educated at universities in Germany,



Courtesy The Bettmann Archive, N.Y.

CAPTURE OF THE WORKS AT PETERSBURG

he founded (1884) the German Colonization Society and led an expedition to Africa in the same year. There he drew up treaties with native chiefs which resulted in the creation of German East Africa. Later he operated with Emin Pasha in equatorial Africa, where he explored the Tana River and penetrated to Lake Victoria. In the early 1900's he made several more trips to the Black Continent and later published valuable reports on his explorations. His "New Light on Dark Africa" (1891) was published in nine languages.

Petersburg (*pe'tērs-bŭrg*), a city in, but independent of, Dinwiddie County, Virginia, on the Appomattox River, 22 m. s. of Richmond. The shipping and manufacturing center of a productive agricultural region, it is served by the Seaboard Air Line, Atlantic Coast Line, and Norfolk & Western R.R.'s. The manufactures include tobacco and peanut products, optical instruments, textiles, luggage, and fountain pens. A military post, Ft. Henry, was established here in 1645. With two other villages it was incorporated as the town of Petersburg in 1784 and became a city in 1850. In the Revolutionary War, Petersburg was taken for the British by Benedict Arnold (1781), and from here Cornwallis launched the attack that culminated in his defeat at Yorktown. In the Civil War it was again the center of a major campaign (see *Petersburg, Siege of*). Population, 1950, 35,054.

Petersburg, SIEGE OF, a campaign in the American Civil War that was a prelude to Gen. Robert E. Lee's surrender of Confederate forces to Gen. Ulysses S. Grant of the Union army. Petersburg was defended by only 2,500 Confederate troops when Gen. Grant marched against

it—with an army of 100,000 men—in June 1864, seeking a foothold from which to take Richmond, Va. Union forces made continuous attacks but were driven back each time with heavy losses. Reinforcements were brought up until, by the end of June, most of the Confederate strength was centered around Richmond and Petersburg. Union forces dug beneath Confederate fortifications and laid mines; and on July 30 one of the forts was blown up, with heavy losses to the Confederates. When Union forces tried to enter the resulting crater, however, they were cut down by the thousands by enemy artillery fire. A stalemate ensued, punctuated by many hard-fought engagements, until March 1865, when Lee made an unsuccessful attempt to break the Union lines and join Gen. Joseph E. Johnston in North Carolina. On April 1 the Confederates were defeated at Five Forks (*q.v.*), and Grant ordered a united attack. Petersburg and Richmond fell on the same day, April 3, 1865, after heavy losses. A week later Lee surrendered to Grant at Appomattox Court House (*q.v.*).

Peterson (*pe'tēr-sŭn*), **FREDERICK**, physician and poet, born in Fairbault, Minn., March 1, 1859; died on July 9, 1938. He studied at the Univ. of Buffalo, N.Y., and became a professor of medical science. A psychiatrist, he was head of the department of nervous diseases in the Coll. of Physicians and Surgeons, New York City, and president (1902-06) of the state commission in lunacy. He published "Mental Diseases" (1899), "American Text-Book of Legal Medicine and Toxicology" (1903), and other medical treatises; among his books, "Poems and Swedish Translations" (1883) and "Creative Re-education" (1936) are noteworthy.

Peterson, SIR WILLIAM, educator and author, born in Edinburgh, Scotland, May 29, 1856; died in 1921. He studied in the public schools, in the Univ. of Edinburgh, and in the Univ. of Göttingen, Germany. A number of institutions of learning granted him degrees. In 1895 he was made principal of McGill Univ., Toronto, where he served for many years.

Peter's Pence (*pēns*), or ROMESCOT, a tax levied in memory of St. Peter for the benefit of the Pope. It is thought to have originated with the kings of Wessex, in the 8th century. The tax was one penny for each family owning a given amount of land. In England it was discontinued in the 14th century and prohibited in 1534. After the Revolution of 1848, the tax was revived as a voluntary contribution in several countries.

Petit (*pē-tē'*), ALEXIS THÉRÈSE, French physicist. See *Dulong, Pierre Louis*.

Petition (*pē-tish'ūn*), an appeal by one or more persons to any organized body or branch of the government, in the form of a written request, praying that a certain grace or right be granted. The right of petition is recognized by most governments as a natural right, and is regarded a fit and convenient means by which the citizen may place before public officials causes and grievances of importance. The Congress of the U.S. is prohibited from making any law to abridge "the right of the people peaceably to assemble and to petition the government for a redress of grievances."

Petition of Rights, a celebrated declaration formulated by the British House of Commons in 1628, which was presented to Charles I. It was formulated for the purpose of limiting the powers of the crown, and obtaining a freer exercise of the personal and civil liberties in the nation. This document was not a new law, but rather a rehearsal of the statutes that had been disregarded by the king, and requested that the ancient rights of the people should be confirmed. It recited the more important provisions of the Magna Carta and called attention to certain statutes passed in the reigns of Edward I and Edward III, particularly those that prohibited forced loans and unlawful taxes and assessments, illegal arrests and imprisonments, a resort to martial law in civil cases, and quartering soldiers upon the premises of private citizens without their consent. At first the king eluded the petition and his subjects were ordered not to meddle with affairs of state. However, the Commons proceeded to take up charges against Buckingham, one of the advisers of the king, and the latter was compelled to yield and assent to the petition.

Petoskey (*pē-tōs'kē*), a city in Emmet County, Michigan, 42 m. s.w. of Cheboygan. It is on Little Traverse Bay, an inlet from Lake Michigan, and on the Pere Marquette and Pennsylvania R.R.'s.

Petoskey has a large inland and lake trade and is popular as a summer resort. The city is also noted for its annual winter sport carnival, held in the Winter Sport Park. Flour, leather, lime, and machinery are among the chief manufactures. Petoskey was incorporated in 1878 and became a city in 1896. Population, 1940, 6,019; in 1950, 6,468.

Petrarch (*pē'trärk*), FRANCESCO, poet and scholar, born in Arezzo, Italy, July 20, 1304; died July 18, 1374. His parents were exiled from Florence before his birth along with Dante and others, owing to their affiliation with the party of the Bianchi, and his early life was spent in Tuscany. In 1313, his father removed to Avignon, where Petrarch secured his early education. Later he studied law at Montpellier and Bologna, but after the death of his father, in 1326, he returned to Avignon and took holy orders, his father's death having left him almost destitute.

On Apr. 6, 1327, he met Laura, a golden-haired French woman, for whom he immediately developed a pure and tenderly romantic passion. She was then 19 and had been the wife of Hugues de Sade, a gentleman of Avignon, for two years. Ever after he sang of his platonic love for this woman. The sonnets of love were so beautiful that they charmed his contemporaries, and induced Charles IV to seek an introduction to the object of the poet's praise.

In 1337, Petrarch left Avignon and established himself at Vaucluse, where he spent most of his time in study and in literary pursuits. His learning and genius attracted the attention of the leading scholars of his time and, in 1341, he was invited to Rome where, on Easter Day, he received from the senate the wreath of poet laureate for his Latin epic, "Africa," the story of Scipio Africanus.

Petrarch spent much time traveling in the countries of Europe to collect materials for his writings, visiting the chief cities of Italy, Spain, Germany, and France. In 1347 he settled in Parma and it was here, in the following year, that he was informed of Laura's death, an event which caused his writing to take a more melancholy turn.

In 1353 he went to Milan and was entrusted by the Visconti, the ruling family of the city, with several diplomatic missions, the most important of which were his mediation between Genoa and Venice in 1353, and his mission to Charles IV in Prague in 1356. In 1369 he settled at Arqua near Padua, where he remained until his death.

Petrarch is generally regarded as a major instigator of the revival of learning which came to be known as the Renaissance. His enthusiasm for the writing and culture of ancient Greece, and more especially of ancient Rome, spread to



PETRARCH

his contemporaries, and although his Latin works never achieved the excellence of those of some later writers, they served the perhaps more important function of stimulating interest in antiquity. He was almost the first major poet to write in Italian. His "*Rime in Vita e Morte di Madonna Laura*," or, as they are generally called, "*Canzoniere*," are his most important work, as well as being among the most beautiful poems in the Italian language. "*Epistolae*," his letters to friends and acquaintances, and "*Trionfi*," six long poems in Italian, belong with his best writings.

Petrel (*pē'trēl*), a genus of sea birds, including many species, all of which have webbed feet and long and strong wings. The nasal tubes are united, the beak is as long as the head, and the upper mandible is hooked. They live almost constantly on the ocean. The petrels that frequent the high seas are rarely seen on the land, coming to shore only to lay their eggs and raise their young. The color is dusky and varied with white or gray, and most of the species are of small size. They feed on mollusks and may be seen upon the water when it is disturbed by storms, for the reason that many of the animal forms upon which they feed rise to the surface at that time. Among the familiar species are the *stormy petrel*, the cosmopolitan *Wilson's petrel*, and the northern *Leach's petrel*. The stormy petrel, sometimes called *Mother Carey's chicken*, is one of the smallest web-footed birds (about the size of a lark). These birds are so named because they appear to walk or run on the water, the allusion being to St. Peter's walking on the water (Matthew 14:28-29).

Petrie (*pē'trē*), SIR (WILLIAM MATTHEW) FLINDERS, archaeologist, born in Charlton, England, June 3, 1853; died in Jerusalem, Palestine, July 28, 1942. He was educated privately. His interest in archaeology was first expressed in work in

PETROLEUM

Great Britain, notably at Stonehenge (see *Stone Circles*). In 1880 he went to Egypt, where he worked until 1924; later (1926-38) he worked in Palestine. Major accomplishments were his study of the pyramids at Gizeh (see *Pyramid*); his excavations of the sites of Naucratis and of Daphnae, Greek cities in Egypt; and his discovery of prehistoric Egyptian remains at Naqada. Noted for his development of archaeological methods, e.g., stratigraphy, he founded what later (1905) became the British School of Archaeology in Egypt, and he was Edwards professor of Egyptology at University Coll., London, England, 1892-1933. Petrie was knighted in 1923. Among his many books and professional papers were "Ten Years' Digging in Egypt, 1881-1891" (1893) and "Seventy Years in Archaeology" (1931).

Petrified Forest (*pē'trī-fīd fār'ēst*). See *Ari-zona*; *Monuments, National*.

Petrograd (*pē'trō-grād*). See *Leningrad*.

Petroleum (*pē-trō'lē-ūm*), a mixture of liquid hydrocarbons (compounds of hydrogen and carbon), sometimes called MINERAL or CRUDE OIL. The name is taken from Latin words meaning "rock oil." Petroleum, which is obtained from subterranean deposits, may have a variety of properties. Some forms are black, others dark green, and some light like kerosene. The liquid may be very viscous or relatively very easy flowing.

Commercial deposits of crude oil and natural gas are always found underground in porous rock, e.g., shale, sandstone, limestone. When a formation of oil-bearing porous rock becomes overlaid by a nonporous formation, oil collects and is sealed in by the nonporous layer. The nonporous layer may form a dome or fold (*q.v.*). In other formations the oil is trapped at a fault (a break in the earth's layers resulting in a vertical shift of layers on one side of the fracture). Natural gas is usually present just beneath the nonporous layer and immediately above the oil. Below the petroleum layer salt water frequently occurs. The petroleum is released from this formation by drilling a well and puncturing the nonporous layer on either side of the top of the dome or fold where the layer of oil is in contact with it. If the peak of the formation is tapped, only gas may be obtained, and if the penetration is made too far from the center of the formation, only salt water may be obtained. The oil in such formations is usually under such great pressure that it flows naturally and sometimes with great force from the well. In some cases, however, this pressure later diminishes to such an extent that the oil ceases to flow and must thereafter be pumped from the well. Natural gas or water is sometimes pumped into the well to replace the oil and the gas which usually accompanies it. This process is called "repressurizing."

The crude petroleum obtained in this way con-

sists of a mixture of hydrocarbons having varying molecular weights and differing from one another in structure and properties. These various species are separated into groups or fractions by a process called *refining*. The petroleum vapors are passed upward through a tower containing equally spaced trays. The vapors are very hot at the bottom but become cooler as they go upward, condensing and collecting on the trays as "fractions" with varying properties. Beginning with the lightest, the fractions of an average crude oil are: (1) gases, (2) liquefied petroleum gases, (3) gasoline, (4) kerosene, (5) gas oil, (6) lubricating oils, (7) fuel oils, and (8) asphalt. Petroleum jelly and paraffin may be obtained from lubricating oil by further refining. Petroleum products are classified by the relative proportions of some of these constituents. An oil yielding relatively large amounts of asphalt is said to have an asphalt base, while one showing a large yield of paraffin has a paraffin base.

Gasoline, which is used in greater quantity than any of the other constituents of petroleum, is obtained in several ways from the mixture. Some gasoline, called straight-run gasoline, is obtained by simple distillation of the crude oil, and large amounts are obtained by breaking down the larger molecules of the less volatile fractions into molecules of a size corresponding to those of straight-run gasoline. This process is called "cracking" and may be accomplished by subjecting these fractions to high temperature and pressure, or by employing a suitable catalyst under more moderate conditions. The cracking

process may be followed by a hydrogenation of the unsaturated fragments of the larger molecules. A third source of gasoline is from the gaseous and highly volatile fractions. These smaller molecules are partially dehydrogenated and are caused to polymerize (*i.e.*, to combine identical molecules), giving, after hydrogenation, a fraction with the desired properties. This process is carried out in such a way that a large percentage of the product is composed of molecules having a branched structure. This gives a gasoline of high octane rating used extensively in aviation fuels.

Petroleum serves as the source of many chemicals. Butadiene, used in the manufacture of synthetic rubber, is obtained from volatile petroleum fractions, while the heavier fractions were used in World War II as the source of a flaming jelly shot from flame throwers used to support men in combat. Waterproofing agents as well as wetting agents are petroleum derivatives.

Petroleum has been known and used since the most ancient times and has been mentioned by most historians since the time of Herodotus. It was used chiefly as a medicine or liniment. The Bible refers to pitch (a petroleum product), used for building purposes (*i.e.*, cementing walls) in Babylon. Petroleum flows from natural springs in many localities. It was obtained from such springs in what is now northern Pennsylvania and western New York by the American Indians, who used it for medicinal purposes. The first oil well was drilled in this region by Edwin L. Drake in 1859; it was 69 ft. deep and produced only 15 bbl. a day.



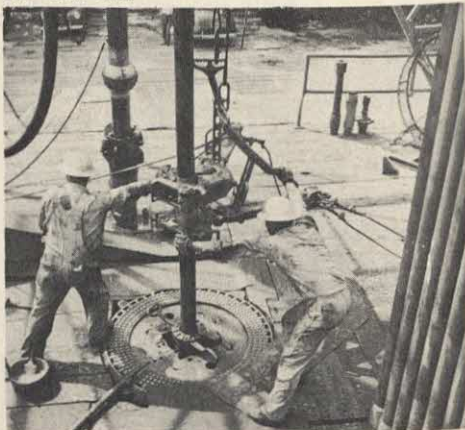
Photos in this series courtesy Standard Oil Co., N. J.

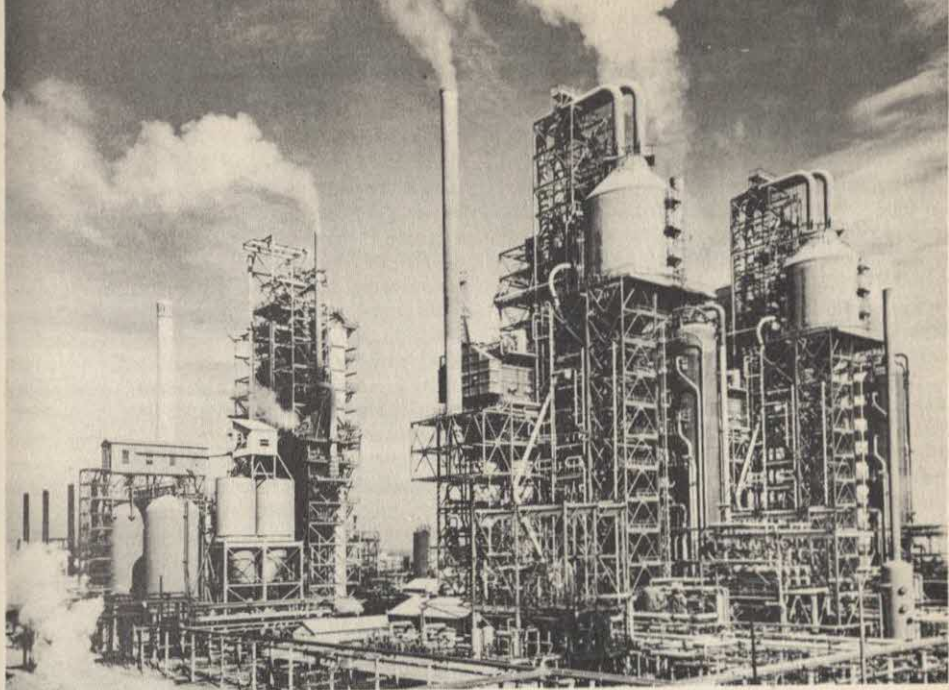
OIL-WELL DERRICK

A tall, strong structure is required to lift the long drill pipe from the well. The pipe is pulled up by means of the long steel cables extending from the top of the derrick to the large block just above the platform

DRILL PIPE BEING LOWERED INTO THE OIL WELL

The long drill pipe with a bit attached to the bottom extends for great distances into the earth. Large wrenches are employed to tighten the joint as another section of pipe is added to the "drill stem." The rotary turntable on the derrick floor is set in motion to turn the "drill stem"





CATALYTIC CRACKERS IN A PETROLEUM REFINERY

In these structures petroleum is subjected to temperature and pressure conditions such that the large molecules of the petroleum, under the influence of a catalyst, are broken down into smaller units which may be converted readily into gasoline

Petroleum is now a vital article of commerce. About 5,400,000 bbl. are produced daily in the U.S. alone. The oil industry is second only to agriculture in the dollar value of its products. The gross assets employed in the U.S. petroleum industry exceed \$30,000,000,000. Net investment in the petroleum industry is more than \$15,000,000,000.

World proved crude-oil reserves have been estimated at 94,000,000,000 barrels. These are widely distributed; in the order of decreasing amounts of oil, these reserves are: (1) Middle East, (2) U.S., (3) Venezuela, (4) Russia (primarily southwestern Russia, although there is evidence of oil on the northern coasts of Siberia), (5) East Indies. In the U.S., oil is produced commercially in 27 of the 50 states. Large producers are California, Illinois, Indiana, Kansas, Kentucky, Louisiana, Ohio, Oklahoma, Pennsylvania, and Texas. Many other states produce smaller amounts.

Petronius (*pê-trō'nī-ūs*), GAIUS, surnamed Arbiter, Roman writer, died in A.D. 66. He lived at the court of Nero, was accused of a plot against the emperor, and committed suicide. A master of elegance, he wrote the satiric novel "*Satirae*," based upon the suffering of a young man in love. *Trimalchio's Banquet*, a mockery on the vulgarity of a wealthy provincial, was the most popular part of this book.

Petrozavodsk (*pyê-trô-zâ-vôtsk'*), a city in

northwestern Russia, capital of the Karelo-Finnish S.S.R. It is situated on the northwest shore of Lake Onega and on the Leningrad-Murmansk railroad. The site was first settled in 1703 because of nearby iron deposits. Industries include iron-works and sawmills, and the city is a trading center for grain, lumber, and fish. The Karelo-Finnish Univ. is located in Petrozavodsk. Population, 1939, 69,728.

Petrucchi (*pâ-trôo'chê*), OTTAVIANO DE, printer, born in Fossombrone, near Urbino, Italy, June 18, 1466; died in Urbino May 7, 1539. Petrucci invented the art of printing music from movable type. He set up a press in Venice in 1491, and in 1498 the council of Venice granted him a monopoly on his invention for 20 years. He prospered until 1511, but then had to sell his rights because further experiments had cost too much money. He thereupon retired to Urbino, where Pope Leo X granted him a similar monopoly for 15 years. His process involved casting each note separately, complete with its staff line, so that typesetting was a task calling for great precision. The surviving specimens of Petrucci's work are valuable rarities.

Pettie (*pêt'î*), JOHN, painter, born in Edinburgh, Scotland, March 17, 1839; died at Hastings, England, Feb. 21, 1893. He studied in the Royal Scottish Acad. and later exhibited in Edinburgh and London. His works include "The Arrest for Witchcraft," "The Disgrace of Cardinal

Waters," "The Drunken Court-Martial," "The Prison Pen," and "The Jacobins in 1793."

Pettigrew (*pet'igru*), known as FRANKLIN, U.S. Senator, born in Ludlow, Vt., July 25, 1848; died in Sioux Falls, S.D., Oct. 5, 1926. He moved to Wisconsin, where in 1869 he was graduated from the Univ. of Wisconsin. The same year, he began practicing law in Sioux Falls, S.D. He was elected to the Dakota legislature shortly after, and in 1876 was chosen as delegate to Congress from Dakota Territory. When South Dakota became a state, he was elected to the U.S. Senate, and was re-elected in 1895. Pettigrew was an active and influential member of Congress. He left the Republican party in 1896 and opposed McKinley's policy of annexing the Philippine Islands. He wrote "Imperial Washington."

Petty Officers (*pet'ē of'is*), in the U.S. Navy, enlisted men holding ranks comparable to noncommissioned officers (e.g.) in the Army. Petty officers hold ranks ranging from seaman, fusser, etc., up to warrant officer. There are four grades of petty officers: chief petty officer, and petty officers of the first, second, and third class. Petty officers are promoted to fill vacancies in the staff of warrant officers and may, under some circumstances, become ensigns in the regular line of promotion.

Peuhavia (*peu'vei-ā*), a genus of plants of the nightshade family, native to the warmer parts of America. The leaves somewhat resemble those of tobacco, especially in having a sticky surface and in emitting a disagreeable odor when crushed. The plants are perennial herbs, and the flowers are either single or double. The perianth is green, chiefly as an annual plant, since it blooms early. Many decorative species have been developed by breeders.



PEUHAVIA PERIANTH

it blooms early. Many decorative species have been developed by breeders.

Pewee (*pu'vee*), an alien of several kinds of birds, chiefly in and back. Other birds are sometimes added, such as crows, to make the alien harder and sometimes antonyms, to give a strong humor, and time, to choose the alien. No regular proportions are necessary, but a few pounds is obtained by using 25 parts of antimony to one part of tin. The best grades contain about one-fifth of lead, the remainder being tin, and in this proportion they were formerly widely used for spoons, snags, pins, and other household articles. Pewee also has many uses in arts, especially engraving and jewelry making.

Pfennig (*pfen'ig*), in German currency, the sixth part of one mark.

Phersheim (*pfers'him*), a town of Germany, in Baden, at the confluence of the Enz with the Neckar, 21 m. s.e. of Karlsruhe. It is on the northern border of the Black Forest. The principal buildings include a Gothic church, the town hall, an industrial school, and the government building. Before World War II the city had manufacturers of jewelry, chemicals, leather, machinery, and electrical apparatus. After Germany's defeat in World War II, Phersheim came under the American Zone of Occupation. Population, 1935, 15,084.

Phaedo (*ph'ed*) or PHAEDON, Greek philosopher, who flourished in the time of Socrates, about the 4th century B.C. He was of noble birth, a native of Elis, but was taken captive and sold as a slave in Athens. He was freed through the influence of Socrates, who became his friend. Phaedo gives his name to the dialogue on the death of Socrates. After Socrates' death Phaedo returned to Elis and founded the Elian school of philosophy.

Phaedra (*ph'edra*), in Greek mythology, the wife of Theseus and the daughter of Minos, King of Crete, and a sister of Ariadne. She fell in love with Hippolytus, her stepson, who did not reciprocate her passion, and she falsely accused him to his father of trying to kidnap her. When Theseus threatened to punish Hippolytus and asked Neptune to destroy him, the god complied. When the innocence of Hippolytus became known Phaedra hanged herself, or according to some, was put to death by her husband. Sophocles and Euripides made the story of Phaedra the subject of tragedies.

Phaedrus (*ph'edrus*), a Latin poet and writer of fables, born about 50 years before the Christian era. He was taken in childhood from Macedonia to Rome, where he became a servant in the court of Augustus, by whom he was freed. Besides translating many fables from Greek into Latin, he wrote many original fables and poems. Ninety-seven fables ascribed to him are extant.

Phaethon (*ph'ethon*) or PHAETON, in Greek legend, the son of Helios, the sun-god, and of the nymph Clymene. He is described as a beautiful youth whose hair was filled with sunbeams. At his request Helios permitted him to attempt to drive the chariot of the sun for one day. When Dawn, the sister of Helios, opened the doors of the east gate, the horses were led to the chariot. Phaethon's face was unsmiling with pain as he could withstand the burning heat, and he immediately summoned the chariot. As he was unskilled in the art of a charioteer, he soon lost control of the fiery steeds, causing the mountains and towers of the earth to be set on fire. A thunderbolt sent by Zeus to stop the steeds hurled the youth headlong into the Ae-

time. His sisters, the Heliades, wept so long for him that Zeus transformed them into poplars, and their tears were converted into transparent amber.

Phaethon (*Παῖθων*), a kind of carriage for glaucous driving. It has a low body and wheels, is drawn by one or two horses, and is somewhat smaller than a buggy; also an early name for an open automobile.

Phagocyteus (*Παγόκυτος*). See *Phagocyte*.

Phalene (*Παλιν*), the order of beetle in which the larva industry of Greece was founded. It consisted of a series of interlocking lines several inches deep, usually from 3 to 16 inches, and the rows were armed with lances from 3 to 14 ft. long. The Spartan phalans was eight ranks deep, while the Theban and Macedonian were much deeper.



SPARTANIAN PHALANX

From a monument, ca. 450 B.C.

Phallus (*Φαλλός*), the male genital organ. In physiological function made the phallus one of the most important symbols in the mythology of early civilizations, in some cases were the only existing religious symbol. As such, it became the object of worship in all nature religions as a symbol of creative power, not only of man but of nature generally. In the basic civilizations of the Western World, individual cults always concerned the worship of a phallus with a specific deity, the Egyptians with Osiris (*g.p.*), the Phoenicians with Adonis (*g.p.*), and the Greeks with Dionysus (*g.p.*). In Egyptian mythology, he is a continuing hereditary ruler with Osiris the male generating principle. A similar symbolism is connected with the Phoenician Adonis or Tammuz (who should not be confused with the Adonis of Greek mythology). In his birth, death and resurrection play the leading role and almost Adonis is the generating principle of growth. The connection of Adonis with Aphro-

dite and Dionysus, which developed later, prove that the Greeks recognized his original identification with the phallic deity. Although, in Greek mythology, Dionysus finally became the god of the vine, of social pleasures generally, even of art, and as related to Apollo, the grace and music, his identification through the phallic nerve ceased. Thus, the phallus played the main role in the experience of the Dionysian cult, and those experiences had always an organic character. The character of the Dionysian cult changed from the most subtle social and artistic representations in songs, music, and dances to crude sexual organs where the harvest of grapes was continued with wild, generally promiscuous, orgies.

Out of these various more or less subtle forms of celebration developed the phallography, which were dedicated solely to preoccupations with the phallic symbols, special phallic songs, etc. Thousands of it sang into the same place and all kinds of crude theatrical performances, where models or symbols of the phallus in grotesque proportions were attached to the actors or used in other ways. Many Greek vase paintings illustrate these phallic and celebratory and scenes of them continued for centuries in Greece and especially in Italy, survived the introduction of Christianity, reappeared in medieval mystery plays as attributes of the devil, and still have appeared in the *commedia dell'arte*.

The most primitive the natural religious were, the more the allegorical character of the phallus was lost and its direct biological character emphasized. The development of some Asiatic and African religions to the point of the important role of the phallus to a religious symbol and of the surprisingly similar forms of worship and celebration. See also *Phallos*.

Phanerogamous Plants (*Παντογὰμοι*), or macrogametes, the name of a division of the vegetable kingdom, including the flowering plants. These plants are called phanerogams, by some writers, to distinguish them from the cryptogams, but the more general name used at present is *spermatophytes*. To this division belong nearly all of the plants that are useful to man and fully sixteen species have been described and classified. They reproduce by seeds that contain an embryo, and therefore differ greatly from the cryptogams, which reproduce by spores composed of single cells that do not have an embryo, see also *Spores*.

Pharaoh (*Παράω*), a name applied by the Egyptians and many Hebrew writers to the rulers of Egypt. It is used as if it were a proper name, but it is only an official title, as that is a title of the Persian rulers, that of the Turans, and one of the Russians. The title corresponds to the *Phaio* found on the monuments of Egypt, which signifies the sun. It is quite difficult to determine



Courtesy British Information Services, N. Y.

TREASURES OF THE PHARAOHS

Principal design on the throne of King Tutankhamen, who reigned ca. 1350 B.C.

the particular monarch to whom reference is made by the use of this title, but generally the application is to the Egyptian king under whom Joseph flourished, and the line under whom the oppression of the Israelites and the exodus took place.

Pharisees (*fär'i-sēz*), a school or sect among the Jews, which possessed much influence during the ministry of Christ. The chief aim of this sect was to preserve the sacred religion of their fathers by resisting all Grecian and other foreign influences. Writers agree that the name was derived from *perushim*, a word meaning separatists, which was used to distinguish them from the priestly aristocracy known as the *Sadducees*. The Pharisees represented a national party of great strength in politics and religion at the time of Christ, and they are mentioned in connection with many of the events associated with Christ and recounted in the New Testament. Their fundamental principle involved the support of both law and sacred tradition, holding that Moses on Sinai came into possession of both written and unwritten law, which he passed to the elders and prophets through Joshua.

The unwritten law of the Jews included the traditions that operated to explain the written law, and in addition to the traditions received from Moses there were others established by the prophets, by wise men, and by decisions of the

PHARMACOLOGY

Great Synagogue. The Pharisees believed that the dead would be resurrected and enjoy future immortality, while the Sadducees thought that the Scriptures did not warrant such a conclusion, and they rejected many of the traditions held by the Pharisees. The *scribes* were teachers and doctors of law that arose from the Pharisees. They were classed as the most learned of the Israelites, and to them were entrusted many positions of importance by the Hebrews and by foreign rulers of later times. In the administration of the law the Pharisees were more liberal than the Sadducees, but their devotion to law and tradition led them to foster exactness in details and lose spiritual life and energy. This tended to lead to self-glorification, though the real Pharisee was one "who did the will of his Father in Heaven, because he loved Him." As a class they were learned and pious, and most of the writers and commentators of their times belonged to this sect. In the teachings of Christ they are represented as proud, intolerant, and hypocritical.

Pharmacodynamics (*fär-mä-kō-dī-nām'iks*).

See *Medicine*; *Pharmacology*.

Pharmacognosy (*fär-mä-kōg'nō-sy*). See *Pharmacology*.

Pharmacology (*fär-mä-kōl'ô-jy*), a broad science which embraces the knowledge of the sources, chemical and physical properties, compounding, physiological actions, absorption, fate and excretion from the body, and therapeutic uses of drugs. (A drug is any chemical agent which affects living protoplasm and which is used as medicine.) The subject of pharmacology is divided into several branches:

Pharmacognosy is a purely descriptive science which deals with the physical characteristics of crude drugs. Because most crude drugs are derived from plants, pharmacognosy is mostly concerned with the botanical sources of drugs and of the characteristics of the plants whence they are obtained. A knowledge of botany enabled the English physician, William Withering, to introduce the great heart drug, digitalis, derived from the foxglove plant, to the practice of medicine in the 18th century.

Pharmacy deals with the art of preparing, compounding, preserving, and dispensing drugs and chemicals for medical purposes. Much of this work was formerly done by the physician himself, but is now left almost completely to the pharmacist. The modern pharmacist must be licensed by the state or national government after thorough training in an accredited college of pharmacy in the sciences of botany, mineralogy, zoology, chemistry, materia medica, and related subjects.

Pharmacodynamics is the science of the actions of drugs on the living organism and is one of the newest of the experimental medical sciences. It is closely allied to the subjects of physiology,



PHARMACIST DEPICTED IN A 13th CENTURY FRENCH MANUSCRIPT

physiological chemistry, bacteriology, and pathology, and has proved of extreme importance in the development of modern knowledge of the functions and diseases of the heart, kidneys, nervous system, etc. Pharmacodynamics is also concerned with the absorption of drugs, their fate in the body, and the mechanism of excretion therefrom. *Comparative pharmacology* is the correlative study of the actions of drugs both in animals and in man, resulting in continuous improvements in practical clinical therapeutics.

Pharmacotherapeutics is the study of the applications of drugs in the treatment of disease. In modern therapy drugs are no longer given in an empirical or trial-and-error manner. The day of the "shotgun" prescription has passed. Drugs are now given on a rational and specific basis in most cases, based upon knowledge of the correlation of the pharmacodynamic action of drugs with the abnormal physiology of disease.

Toxicology is the science of poisons. This broad division of pharmacology includes the origin, chemical properties, toxic actions, and the detection of poisons. It also includes the treatment of toxic actions produced by poisons. As defined by Peterson, Haines, and Webster (1923), "A poison is a substance, which, when introduced into the body in relatively small quantity and acting chemically, is capable of producing death or serious injury to health in the case of an ordinary individual in average health." All drugs are potentially poisonous, and hence their use should be limited to that prescribed by the trained physician.

Chemotherapy is the treatment of infectious diseases based on the affinity between various chemical agents and the body tissues or invading microorganisms. This includes the local use of antiseptics and disinfectants, and the systemic use of such drugs as penicillin, sulfadiazine, and other antibiotics. See also *Medicine*.

Pharmacopoeia (*jär-mà-kò-pè-yà*), the name applied to a book of formulas and directions

for the preparation and use of drugs in the treatment of diseases. Such a book may be compiled either by individuals or by a commission under the direction of the government. Most works of this kind consist of two parts, a list of drugs and the tests for determining their purity, and a collection of recipes or prescriptions to compound them for the treatment of diseases. A national pharmacopoeia is in use in nearly every civilized country, but those of France, Germany, and the U.S. are the most extensive. In nearly all cases these books are prepared by national conventions, at which the medical colleges and societies are represented by delegates. The first work of the kind was prepared in 1542 at Nuremberg, Germany, and revisions of this and others have appeared from time to time. Conventions are held from time to time at Washington, D.C., to revise the pharmacopoeia in use in the U.S. The first edition was published in 1820 and successive issues have appeared about every 10 years. It is required that pharmacists and physicians be well acquainted with this work, both for the good of the medical practice and because it is authorized by the legislatures of states and the laws of Congress.

Pharmacotherapeutics (*jär-mà-kò-thër-à-pū'tiks*). See *Pharmacology*.

Pharmacy (*jär-mà-sy*). See *Pharmacology*.

Pharos (*jär-ròs*), the ancient name of a small island off the coast of Egypt, near the city of Alexandria. It was connected with the mainland by a mole and was famous for its lighthouse which was considered one of the seven wonders of the ancient world. This lighthouse, or Pharos, was erected by Ptolemy I and his son, Ptolemy Philadelphus, and was finished about 282 B.C. It had a square base measuring about 100 ft. on a side and, according to some writers, was 400 ft. high. In 1303 it was destroyed by an earthquake, having stood intact about 1,600 years. The island has been modified by the action of the elements so as

to form a peninsula. It is now partly occupied by the city of Alexandria.

Pharynx (*fār'ink's*), the muscular, membranous sac located between the lower part of the mouth and the esophagus. It is wider above than below and is suspended from the base of the skull, opening below the esophagus and larynx. The pharynx has seven openings, four above and three below the soft palate. The former consists of two openings leading forward to the nostrils and the two Eustachian tubes to the middle ears, and the latter include one to the mouth, one to the larynx, and one to the esophagus. It is essential in modifying or producing the higher tones of the voice and in swallowing.

Pheasant (*fěz'ant*), a genus of birds found originally in Asia, but brought to Europe at an early date in history. They were introduced to North America from Europe. The pheasants include a number of species and with them are usually associated the numerous allied birds, all of which are highly prized as game birds. In all species the bill is short and curved, the skin surrounding the eyes is destitute of feathers, and the male has a spur on the tarsus. The males of the *common pheasant* have beautiful plumage and attain a length of 3 ft. from the tip of the bill to the end of the tail, fully half of this comprising the tail. In the female the plumage is less beautiful and the tail is much shorter. Most males have the plumage variously colored, ranging from greenish-purple and brown to golden-red with shades of black, while the females have yellowish-brown plumage.

Pheasants may be domesticated, in which state they breed freely, and they interbreed with the common fowl, guinea fowl, grouse, and other birds of this class. In a wild state they roost largely on the low branches of trees, or in the undergrowth, and feed on seeds, insects, worms, berries, and tender parts of plants. The name

is sometimes applied to the ruffed grouse and the partridge of North America, the lyre bird of Australia, and other birds, but it applies more correctly to the common pheasants of Asia described above. Foremost among the European species is the *English pheasant*, in which the male is provided with beautiful plumage, shaded chiefly with red, black, and orange. The female, which is somewhat duller, lays from 10 to 15 eggs, usually in a thicket or dense hedge. The *golden pheasant*, *impeyan pheasant*, and *argus pheasant* are other distinct species.

Phelps (*fělp's*), WILLIAM LYON, educator, literary critic, and writer, born Jan. 2, 1865, at New Haven, Conn.; died Aug. 21, 1943, at New Haven. The son of a Baptist minister, he received degrees of B.A. in 1887 and of Ph.D. in 1891 at Yale Univ., also an M.A. degree at Harvard in 1891. Beginning to teach at Yale in 1892, he was Lampson Professor of English Literature at that university from 1901 until he retired in 1933 as professor emeritus. He also conducted a book department in *Scribner's Magazine* for many years, and gave lectures before cultural and civic groups throughout the U.S. His books, chiefly of criticism, include "Essays on Modern Novelists," "Essays on Russian Novelists," "Human Nature in the Bible," "Browning," "What I Like in Poetry," "Autobiography With Letters," and "Marriage." He was awarded the gold medal of the National Institute of Social Science in 1930, the American Educational Award in 1940, and honorary doctorates from various universities, including Columbia, Brown, Colgate, and New York.

"Billy" Phelps was known to several generations of Yale students as an original personality,

WILLIAM LYON PHELPS

Photo by Underwood & Underwood, courtesy Macmillan Co., N. Y.

GOLDEN PHEASANT

Courtesy N. Y. Zoological Society



witty and humane. In 1895, when only time-honored classics were considered worthy of study, he was the first American educator to introduce courses in modern fiction and drama, and he also pioneered in acquainting the English-reading public with Russian novelists. Among his students were Sinclair Lewis, Thornton Wilder, Stephen Vincent Benét, and other future notables in the world of letters.

Phenacetin (*fě-nās'ě-tin*) (ACETOPHENETIDIN, PARA-ACETPHENETIDIN, ETHOXYACETANILID). Employed as an antipyretic and analgesic, it is similar to acetanilid in its medicinal action, but less toxic.

Phenol (*fě'nōl*) (HYDROXYBENZENE, C_6H_5-OH). A white crystalline mass, which is a strong corrosive poison. It is used as a disinfectant, and also in the manufacture of picric acid, pharmaceuticals, dyes, synthetic resins, plastics, explosives, paint removers and medicines.

Phenomenalism (*fě-nōm'ě-nāl'iz'm*), in philosophy, the doctrine common to a number of divergent beliefs which hold that human knowledge is limited to the apprehension of phenomena. Although differing as to the ultimate nature of reality, all phenomenologists agree in the denial of intuitive principles.

Phenomenology (*fě-nōm'ě-nōl'ō-jī*), in philosophy, has been variously used as a name for a number of distinct fields of inquiry. In one of its uses, it covers the study of the basic properties common to all objects of scientific knowledge—such properties as space, time, and motion. In another usage, it denotes the analysis of the stages through which the human mind and human institutions are supposed to pass in their progressive development toward full maturity—stages which at the same time are alleged to be the incomplete manifestations of a world spirit gradually revealing itself to human understanding. It has been employed in still another sense for the descriptive study of individual mental phenomena. In a fourth sense, it has been used as a label for the analysis of the fundamental categories of experience, emotional and esthetic as well as cognitive, such as spontaneity, individuality, conflict, regularity, and growth. In recent philosophy, however, it is employed almost exclusively for the type of analysis developed by the German philosopher Edmund Husserl (1859-1938) in his "Logical Investigations" (1900), "Ideas for a Pure Phenomenology" (1913), "Formal and Transcendental Logic" (1929), and other writings. According to Husserl, phenomenology is the description (as distinct from the causal explanation) of purely subjective mental processes. It differs, though, from a descriptive introspective psychology, in that it is directed toward the immediate apprehension of the *general forms* of consciousness which

are embedded in the flux of psychic material, and not toward the temporarily specific exemplifications of these forms. According, phenomenology is claimed to make no assumptions concerning existence, and to be concerned entirely with pure possibilities or essences. Phenomenology is thus asserted to be the fundamental science, for in analyzing the basic forms of consciousness it also reveals the basic types (or essences) of objects toward which consciousness can be directed. It is therefore the science, according to Husserl, which apprehends by direct intuitions the necessary structures of all fields of possible experience.

Phenotype (*fě'nō-tīp*), a biological term, meaning characteristics exhibited by an individual without respect to the undeveloped genes.

Phi Beta Kappa (*fī bā'tā kăp'ă*). See *Fraternities*.

Phidias (*fīd'ī-as*), sculptor, born in Athens, Greece, ca. 500 B.C.; died ca. 432 B.C. Details of his personal life are not known, but enough of his sculpture remains to permit an accurate assessment of his artistic life. It is known that he was a pupil of the Greek sculptor Hegias and that he was one of those commissioned by Pericles (q.v.) to provide decorations and sculptures for the great buildings of Athens. Phidias, and pupils under his supervision, did much of the decoration of the Parthenon (q.v.).

The most famous of Phidias' individual statues was that of the goddess Athena Parthenos, located in the Parthenon. Since this statue, which was about 14 yd. high, was executed in ivory and gold, the original has long since perished, but much information has been obtained about it from later copies and from its likeness on the obverse side of coins. The erection of the Athena of Parthenos in 438 B.C. affords the only exact known date of any of the work of Phidias. A second (open-air) statue of the goddess was erected by Phidias in bronze and was placed on the Acropolis of Athens, between the Parthenon and the Propylea (q.v.), and called Athena Promachos.

Although there is doubt about the authenticity of other works by Phidias, it is known that sometime between 448 and 432 B.C. he executed in gold and ivory a colossal statue of Zeus at Olympia. Without regard to the doubtful works, the known works of Phidias are sufficient to establish him as one of the greatest of the classical Greek sculptors. For picture, see next page.

Phigalia (*fī-găl'yă*), an ancient Greek city in the mountainous southwest region of Arcadia. Most of its city wall remains, though its temples and works of art have disappeared. The temple dedicated to Apollo, at Bassae, a short distance outside the ancient city, is thought to be second in beauty only to the Theseum (q.v.) at



SCULPTURE BY PHIDIAS

Shield of the Athena Parthenos

Athens. A sculptured frieze depicting battles between Centaurs and Lapiths and Amazons and Greeks, and measuring over 100 ft. in length by 2 ft. in width, was placed in the British Museum in 1812.

Philadelphia (*fil-q-dēl'fi-q*), a city and port of entry in southeastern Pennsylvania, seat of Philadelphia County and coextensive with it. The largest city in Pennsylvania and the fourth-largest in the U.S., it is known as the "City of Brotherly Love" and the "Quaker City." Philadelphia is situated at the junction of the Delaware and Schuylkill rivers. It is connected with the Atlantic Ocean by a 40-ft. channel. Its deepwater harbor on the Delaware River, with a frontage of 20 m., can accommodate large ocean-going ships.

As planned originally by William Penn and Thomas Holme, the surveyor, the city covered an area of 2 sq. m. in the vicinity of the two rivers. Numerous independent settlements developed in the surrounding areas throughout the years. In 1854 these districts were all absorbed as part of the city proper. Among these sections were Germantown, Chestnut Hill, Frankford, Nicetown, Roxborough, Manayunk, and Kensington. The "Main Line," named for its location along the Pennsylvania R.R., includes numerous independent communities originally in the Welsh Tract, the land set aside by Penn for Welsh Quakers. Here are Merion, Cynwyd, Bryn Mawr, Ardmore, and Narberth. The city comprises an area of 129.71 sq. m. The Philadelphia standard metropolitan statistical area (3,550 sq. m.; pop., 1960, 4,342,897) includes Montgomery, Delaware, Bucks, and Chester counties in Pennsylvania and Gloucester, Camden, and Burlington counties in New Jersey. Its value added by manufacture in 1958 totaled \$4,826,261,000.

The two principal streets are Market and Broad.

PHILADELPHIA




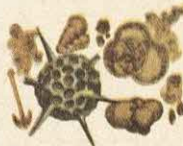
Streets running north and south of Market are numbered, while those running east and west are named. Another important thoroughfare is the Benjamin Franklin Parkway, extending from the City Hall to Fairmount Park. The main shopping area is in the downtown section, on Market, Chestnut, and Walnut Sts. Elfreth's Alley is the oldest street in the country where the homes have been occupied continuously. The city has become known for certain traditional foods that originated here, among them pepper pot soup, scrapple, cinnamon buns, and ice cream. The Mummers' Parade held on Jan. 1 of each year is a regular feature since Jan. 1, 1876. Philadelphia has three nationally known professional athletic organizations—the Phillies, a National League baseball team; the Warriors, a basketball team; and the Eagles, a football team.

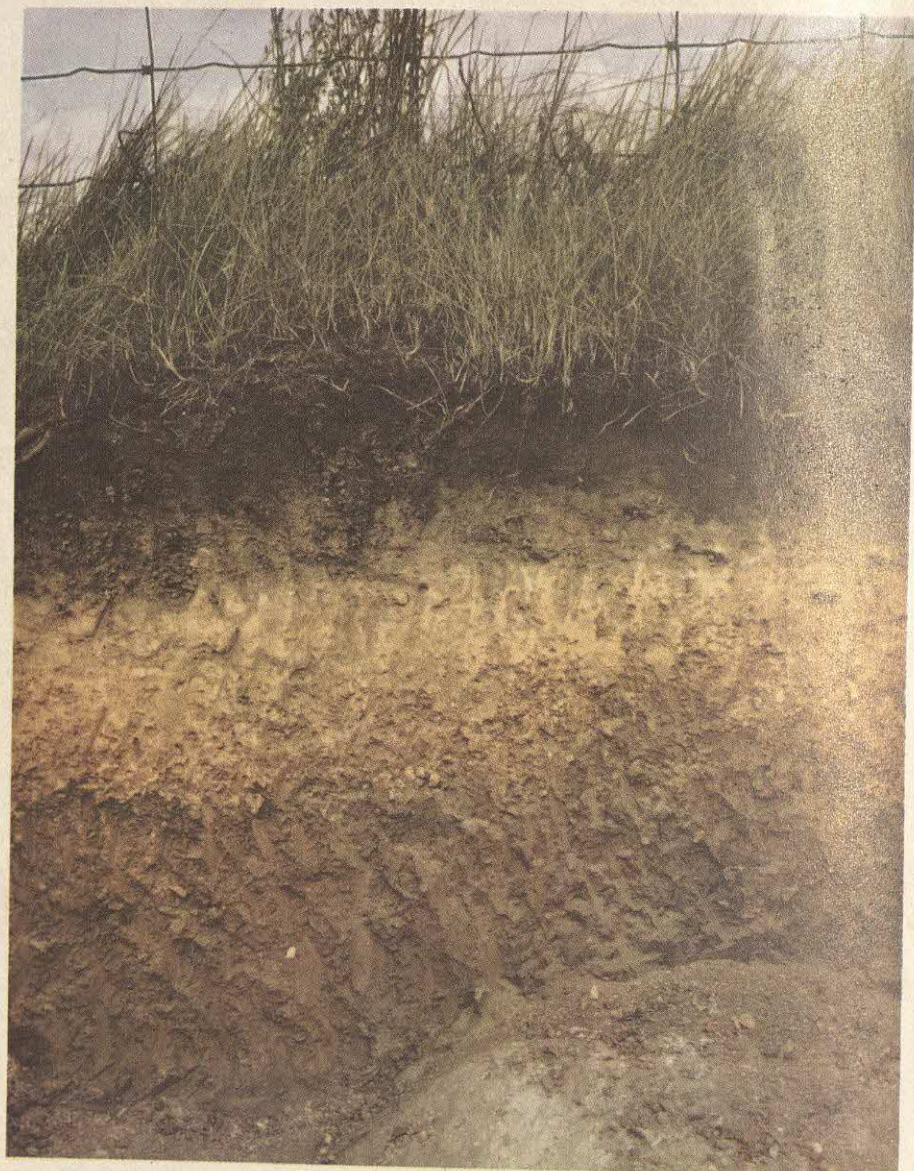
Parks and Recreation Centers: Extending along the Wissahickon Creek and Schuylkill River and reaching almost to the center of the city, Fairmount Park covers 4,000 acres. Cobb's Creek Park covers 786 acres, and Pennypack Creek Park, 1,260 acres. Throughout the city are several smaller parks, squares, picnic groves, swimming pools, and other recreation centers.

Historic Landmarks: Independence Square and its buildings cover 4.55 acres, probably the most historic ground in the U.S. Located here is Independence Hall (*q.v.*). On the west side of Independence Hall is Congress Hall, at 6th and Chestnut Sts.; on the east is the old City Hall, at 5th and Chestnut Sts., where the first Supreme Court met. Since 1945 this entire area has been named Independence National Historic Park. Nearby is Carpenters' Hall (*q.v.*). Also in the vicinity are the U.S. Custom House, built in 1819, and the First Bank of the United States, erected in 1795. Washington Square marks the resting place of several hundred Revolutionary War soldiers and many victims of the Yellow Fever epidemic of the 1790's. The Betsy Ross House is said to be the place where the first American Flag was made, while the Pennsylvania Hospital, founded by Franklin, was the first hospital in the U.S. In the burial ground of the Congregation Mikve Israel is the grave of Rebecca Gratz, the *Rebecca* of Scott's "Ivanhoe." Among the historic churches are Christ Church, built in 1727; the Friends' Meeting House, built in 1804; St. Peter's Episcopal Church, built in 1761; Gloria Dei, more familiarly known as Old Swedes' Church, erected in 1700; St. George's Methodist Church, begun in 1763; Old St. Joseph's Roman Catholic Church, organized in 1733; the oldest Roman Catholic parish in Philadelphia; and St. Mary's Roman Catholic Church, built in 1763.

Modern Structures: Among the leading hotels are the Sheraton, the Benjamin Franklin, Bellevue Stratford, John Bartram, Warwick, and the Bar-

GEOLOGIC TIME CHART

ERAS		PERIODS	DURATION IN YEARS	DOMINANT LIFE	CHARACTERISTIC LIFE
CENOZOIC		RECENT	10,000	Man	
		PLEISTOCENE	1,000,000		
		PLIOCENE	6,000,000	Mammals	
		MIOCENE	12,000,000		
MESOZOIC		OLIGOCENE	16,000,000		
		EOCENE	20,000,000		
		PALEOCENE	5,000,000		
		CRETACEOUS	65,000,000	Reptiles	
		JURASSIC	35,000,000		
		TRIASSIC	35,000,000		
PALEOZOIC		PERMIAN	25,000,000	Amphibians	
		CARBONIFEROUS	85,000,000		
		DEVONIAN	50,000,000	Fishes	
		SILURIAN	40,000,000		
		ORDOVICIAN	85,000,000	Invertebrates	
		CAMBRIAN	70,000,000		
PROTEROZOIC		UPPER PRECAMBRIAN	650,000,000	Primitive Multicellular Forms	
ARCHEOZOIC		LOWER PRECAMBRIAN	650,000,000	Unicellular Forms	 Magnified 300 Times



Courtesy U. S. Soil Conservation Service; photo by Anne Ware

SOIL PROFILE OF HIGH YIELD FARM LAND

Life-giving topsoil filled with rootlets and supporting luxuriant grass is seven inches deep, dark colored and crumbly. The granular soil — the second layer — absorbs rain, holds moisture, provides abundant plant food and protects the land against the ravages of nature. The sub-soil — the bottom layer — is moderately compact and of medium thickness over limestone bedrock.

clay. The Philadelphia Saving Fund Society occupies a modern skyscraper building (for illustration, see *Architecture*); and Convention Hall, built in 1931, has a seating capacity of more than 14,000. The Cathedral Church of Christ (Protestant Episcopal) and the Cathedral of SS. Peter and Paul (Roman Catholic) are important religious structures. The Municipal Stadium is the site of many athletic events, including the annual Army-Navy football game.

TRANSPORTATION: The Baltimore & Ohio, the Pennsylvania, the Reading, and other railroads serve the city. There are two airports, the North Philadelphia Airport and the Philadelphia International Airport; they are about 14 m. and 6½ m. from the downtown section, respectively. The city has the second-largest port in the country, with over 250 piers and wharves. Bridges connecting the city with New Jersey are the Benjamin Franklin Bridge (1926, from Franklin Square to 6th and Penn Sts., Camden), the Tacony-Palmyra Bridge (1929, from Levick St. to Palmyra), and the Walt Whitman Bridge (1957, from Packer Ave. in South Philadelphia to Gloucester City).

INDUSTRY AND COMMERCE: From the days preceding the Revolution, Philadelphia has been an important nucleus of trade and manufacturing. In the 19th century it became a shipbuilding center. It is headquarters for naval district No. 4; the Philadelphia Naval Shipyard is one of the world's largest. Located in the city are a U.S. Mint and the Frankford and Schuylkill Arsenals; and the Federal Reserve Bank, District 3, is also here. The principal industries are food processing, publishing, oil refining, and the manufacture of paper, textiles, leather, glass, chemicals, tobacco, apparel, furniture, machinery, and instruments. The city had a value added by manufacture of \$2,555,508,000 in 1958.

EDUCATIONAL AND CULTURAL INSTITUTIONS: Currently, the public-school system enrolls about 275,-

000 pupils annually, and another 135,000 are educated in parochial schools. Noted schools of higher learning include the Univ. of Pennsylvania, Temple Univ., LaSalle Coll., St. Joseph's Coll., Dropsie Coll. for Hebrew and Cognate Learning, Chestnut Hill Coll., Drexel Inst. of Technology, and Curtis Inst. of Music. The medical schools include the Coll. of Physicians, Jefferson Medical Coll. of Philadelphia, and Hahnemann Medical Coll. The Pennsylvania Acad. of the Fine Arts was founded in 1805, the oldest art school in the country. Also in the city are the Philadelphia Textile Inst., the Moore Inst. of Art, Science and Industry, and the Philadelphia Museum Coll. of Art. Among the museums are the Philadelphia Museum of Art, the Commercial Museum, the Acad. of Natural Sciences, and the Fels Planetarium. The Aquarium is located along the Schuylkill River. The Free Library, with more than 2,000,000 items, includes a fine collection of Americana. Philadelphia is the seat of several learned societies; among them is the American Philosophical Society, founded in 1769 by Benjamin Franklin. The Acad. of Music, founded in 1857, is the city's music center, where the Philadelphia Orchestra (*q.v.*) presents concerts and where other events are held. At Robin Hood Dell in Fairmount Park, summer concerts are given, while plays are presented in the Playhouse in the Park. The Walnut Street Theater, founded in 1808, is the oldest theater in the country.

GOVERNMENT: Philadelphia, operating under a 1951 charter, is governed by a mayor, elected every four years, and a 17-member city council, serving for four years. Participating in the city government are a managing director, appointed to a four-year term, and other appointed officials.

HISTORY: In 1609 Henry Hudson of Holland sailed into the Delaware River in his ship the *Half Moon*. Living in this area were the Lenni-Lenape Indians. In the succeeding years of the

PHILADELPHIA FROM THE BENJAMIN FRANKLIN PARKWAY

Courtesy Philadelphia Chamber of Commerce



PHILADELPHIA

17th century, the Dutch settled in this district, while in the 1630's the Swedes settled along the Delaware. Various colonies of English also set up residence. In 1681, under a charter signed by Charles II, the land now covered by the state of Pennsylvania was granted to William Penn, who named the area Philadelphia, a Greek word meaning "brotherly love." In 1682 Penn and a group of Quakers arrived in the ship *Welcome* to take up residence. According to legend, he made a treaty with the Indians under an elm tree at the Indian village of Shackamaxon, the site of the present Kensington, a section of Philadelphia, confirming his purchase. Under the promise of religious freedom and the opportunity to advance economically, numerous religious and national groups came from Europe. Philadelphia flourished, steadily increasing in size and becoming in the 1700's the second-largest city in the British Empire, second only to London. Its trade and merchants prospered, and in time the city became a center about which the rest of colonial life revolved in culture, finance, science, political activity, and manufacturing. The first and second Continental Congresses convened here in 1774 and 1775. In 1776 the Declaration of Independence was signed in Independence Hall. The city and its surrounding area witnessed several battles during the Revolutionary War, and British forces under Gen. Howe occupied the city in 1777-78. In 1778 the Articles of Confederation were adopted in Philadelphia, and in 1787 the Constitution of the U.S. was signed here. From 1790 until 1800 the city was the capital of the Federal government. In 1796 Washington made his famous Farewell Address in Congress Hall. From 1683 until 1799, the city was the capital of Pennsylvania. During the War of 1812, Philadelphia supplied ships and sailors and in the succeeding years continued to expand in population, industry, and building. It was a center of antislavery activity, and during the Civil War it was a focal point for the assembling of Union forces and a distributing and manufacturing center of military and related supplies. In 1876 the Centennial Exposition was held, and in 1926, the Sesquicentennial. Philadelphia continued to grow as an economic and cultural center in spite of its proximity to New York City. Following World War II, \$2,000,000,000 were invested in slum clearance, development of housing projects, recreational facilities, and related projects, and a \$250,000,000 plan was evolved for the redevelopment of the "center-city," including the destruction of the old Broad St. railroad station and tracks, and the construction of many apartment and office buildings, as well as the Sheraton Hotel, to occupy the space.

In 1776 Philadelphia had a population of 35,000. In 1840 it was 258,037, and in 1900, 1,293,697. The city's decade of greatest growth was from



Courtesy Philadelphia Chamber of Commerce

PHILADELPHIA MUSEUM OF ART

1910, when the population was 1,549,008, to 1920, when it was 1,823,779. In 1950 the population was 2,071,605; in 1960, 2,002,512.

Philadelphia Museum of Art, founded in Philadelphia, Pa., in 1875 to house the Centennial Exposition of 1876. It was later expanded to house permanent collections of European old masters, contemporary art, and Persian and Chinese art. Formally opened in March 1928, it now presents annual exhibitions of paintings, sculpture, prints and drawings, and representative examples of the decorative arts, including English 18th-century furniture, tapestry, and ceramics, which make up its extensive collection. The museum also maintains a film library and a division of education and manages the Samuel S. Fleisher Art Memorial, an adult art education school opened in 1944. Connected with the museum are the School of Industrial Art and the Philadelphia Textile Inst.

Philadelphia Orchestra, a concert ensemble organized in Philadelphia, Pa., by Fritz Scheel in 1900. Under the leadership of Leopold Stokowski (*q.v.*), the orchestra's permanent conductor from 1912 to 1936, it won rapid recognition in the musical world. Its summer series of outdoor concerts sponsored by the Philadelphia City Council in Fairmount Park's Robin Hood Dell has given it tremendous popularity. Since 1936 Eugene Ormandy has been the permanent conductor of the orchestra, which also appears regularly in New York City and frequently goes on concert tours.

Philae (*fī'lē*), an island in Upper Egypt, in the Nile River above the Aswan Dam. The site of ancient and classical temples built by the Ptolemies and the Caesars (600 B.C.-A.D. 600), it is now submerged except from July to October when the sluices of the Aswan Dam are open. Most renowned of its architecture is the temple dedicated to Isis and built by Ptolemy II *ca.* 286 B.C.

Philately (*fī-lāt'ē-lī*), the study and collection of postal stamps and similar items issued by post offices. Collecting stamps became a popular hobby soon after the appearance of the first British stamps in 1840. It became a serious study about 1860, when all details such as watermarks, perforation, shading, etc. were subjected to scien-

tific observation. In Europe, particularly in England, France, and Germany, as well as in the U.S., philatelists collected and exchanged extensively, even before the founding (1869) of the first club, the Philatelic Society of London, which still maintains a leading position among stamp collecting societies. The value of any stamp depends on its rarity and condition.

Philemon and Baucis (*fi-lē'mōn and bō'sis*). See *Baucis* and *Philemon*.

Philip (*fil'ip*), SAINT, one of the Twelve Apostles, born in Bethsaida in Galilee, in the 1st century. He was the fifth to be called, having been preceded as an apostle by Peter, Andrew, James, and John. It is recorded that he brought Nathanael to Christ, that he was present at the miraculous feeding of the multitude with five loaves and two fishes, and that he was with the other apostles at the religious assembly following the Resurrection (John 1:45 ff.; 6:5-7, Acts 1:12-14). It is said that he met his death at Hierapolis, in Syria. He is commemorated on Nov. 14 by the Greek Catholic Church and on May 1 by the Roman Catholic Church.

Philip, SAINT, known as *Philip the Evangelist*, one of the seven deacons chosen by the Twelve Apostles, born in the 1st century; sometimes confused with Saint Philip the Apostle (*q.v.*). He preached with great success at Samaria and converted a eunuch of Queen Candace of Ethiopia, an incident that was partly responsible for bringing Christianity to northeastern Africa. Philip's four daughters were Christian prophetesses. (Acts 6:5, 8:25 ff., 21:8-10). His feast day is June 6.

Philip, DUKE OF EDINBURGH, PRINCE, CONSORT OF Queen Elizabeth II of England, born on the island of Corfu, Greece, June 10, 1921. The son of Prince Andrew of Greece and Princess Alice, sister of Earl Louis Mountbatten of Burma (*q.v.*), he is the great-great-grandson of Queen Victoria of England. Since the age of eight he has lived in England, where he attended the Dartmouth Naval Coll. During World War II, he served in the British Navy, and, in 1947, he became a British subject, adopting his mother's name of Mountbatten and giving up his Greek and Danish titles. Shortly before his marriage, on Nov. 20, 1947, to Queen Elizabeth II (*q.v.*), then Princess and heiress presumptive, he was created Duke of Edinburgh, Earl of Merioneth, and Baron Greenwich.

Philip, KING, American Indian chief, born ca. 1639; killed near Mt. Hope (Bristol), R.I., Aug. 12, 1676. The son of Massasoit, Philip (Metacom) became chief of the Wampanoags in 1662. White pressure on the Indians of New England had increased for some time, and when three of his tribe were executed for their murder of an Indian informer Philip and his Indian allies started the conflict known as King Philip's War. Fighting

began at Swansea, Mass., in June 1675. After a year's hostilities, Philip was betrayed. He was killed by a renegade in Capt. Benjamin Church's party, his family was sold into slavery, and the tribe was almost annihilated. King Philip's War was the major Indian uprising in New England, resulting in the destruction of a dozen white settlements, severe damage to many others, great financial losses to the colonies, and the death of 600 colonists.

Philip, the name of five kings of Macedon, of whom Philip II (*q.v.*) is the most important. *Philip III* succeeded Alexander the Great in 323 B.C., having been elected as king by the army, and in 317 was defeated and put to death by Olympias, mother of Alexander. *Philip IV* was a son of Cassander and reigned only a few months, in 296. *Philip V* was the son of Demetrius II. He was born in 237 and succeeded to the throne in 220—the last but one of the Macedonian kings. He died in 179 B.C.

Philip II, King of Macedon, father of Alexander the Great, born in 382 B.C., assassinated in Aegae, Macedonia, August, 336 B.C. The son of Amyntas II, he was a hostage in Thebes (367-364 B.C.) where he gained his knowledge of Greece. He succeeded his brother, Perdiccas III, as king in 360, his first work being the reorganization of the army. Utilizing the Theban phalanx formation, he established an effective national army and entered upon a successful career of conquest. He captured Amphipolis and Potidaea, founded Philippi, and subdued nearly all of Thessaly. In 351 B.C. Demosthenes began the first of his speeches (the "Philippics") warning the Athenians against the growing power of Philip. Meanwhile, Philip captured the stronghold of Chalcidice. He concluded a peace with the Thracians and made himself master of the cities of Phocis and the Pass of Thermopylae. Soon after he intervened between the warring forces of Phocis and Thebes, and in 340 B.C. became commander in chief of several Greek states. When Athens and Thebes formed an alliance against him, he defeated their forces in a decisive battle at Chaeronea in 338 B.C., and thus became sovereign of all the Greek states. He immediately began to plan for an invasion of Persia with the purpose of avenging the injuries done to Greece. Deputies were summoned from all the Hellenic states to plan an expedition with that end in view, and Philip was elected commander in chief. His assassination occurred shortly afterward at the marriage of his daughter to Alexander of Epirus. Philip's military successes prepared the way for the conquests of Alexander the Great.

Philip I, King of France, son of Henry I, born in 1052; died July 29, 1108. In 1059 he became associated in the government with his father, but succeeded him in 1060 under the regency of his



PHILIP I

mother, and afterward reigned under that of Baldwin V, Count of Flanders. During his reign the Normans conquered England, in the year 1066. His son, Louis, became joint king in 1100 and succeeded him at his death as Louis VI.

Philip II, *AUGUSTUS*, King of France, son of Louis VII, born in August 1165; died in Nantes, July 14, 1223. In 1179 he became joint king with his father and the following year succeeded to full sovereignty. He wedded the daughter of the Count of Hainault, a descendant of the Carolingians, and thus strengthened his position on the throne. The Jews were banished from his kingdom in the early part of his reign, and their property was confiscated. In 1189 he formed an alliance with Richard the Lion Hearted of England, by whose influence the Third Crusade to the Holy Land was organized. Soon after returning from Palestine, in 1193, he invaded Normandy, Richard being at that time a prisoner in Germany, and after his release a war raged between England and France until 1199, when it was terminated through the kindly office of Pope Innocent III. After the death of Richard, King John and Prince Arthur were rival claimants for the English possessions in France and Philip supported the claims of the latter. When Arthur was assassinated, Philip annexed Anjou, Normandy, Touraine, and Maine to France, and his claim was firmly established by winning victories over the Germans under Emperor Otho and the English at Bouvines on Aug. 29, 1214. The later part of his life was devoted to civil and industrial reforms and the building of fortifications, canals, and schools. He strengthened the walls of Paris, paved its streets, and fortified the principal towns of France.

Philip III, King of France, born in 1245; died at Perpignan, Oct. 5, 1285. He was the son of Louis IX, whom he succeeded in 1270, while conducting a siege at Tunis. Soon after he signed a

PHILIP VI

10-year truce and returned to France, where he suppressed the revolt of Roger in 1272. His death occurred in the midst of a war with Peter of Aragon, who had invaded Sicily and massacred a large number of French.

Philip IV, surnamed *The Fair*, King of France, born at Fontainebleau in 1268; died there Nov. 29, 1314. He was the son of Philip III, married Joanna, Queen of Navarre, in 1284, and the following year succeeded his father as King of France. By his marriage Navarre, Brie, and Champagne were added to the royal domain, and early in his reign he curtailed the vassals in their influence. He was successful in a long war with Flanders, which resulted in annexing the Walloon territory and in adding Guienne, formerly possessed by the English. His reign became famous for his opposition to the freedom of the clergy from taxes, which brought on an extended contest with Pope Boniface VIII. Philip imprisoned the papal legate in 1300, publicly burned a bull issued by the Pope, and caused the prelates who sided with Boniface to have their property confiscated. When Boniface excommunicated him, he sent William de Nogaret with a military force to Rome, where the Pope was imprisoned for a short time.

After the death of Boniface VIII, Philip exercised his influence in electing Clement V to the papal throne under the condition that Avignon should be the papal residence and the Knights Templar should be abandoned. In the period from 1306 to 1314 many hundreds of Templars were martyred and their property was confiscated. Philip, as a sovereign, exercised much energy in establishing royal power by suppressing feudalism. He likewise promoted extensive civil, industrial, and military reforms. His system of government caused a great rise in taxation, for which reason he resorted to confiscating the property of Jews, Templars, and political opponents, and at one period in his reign the currency became greatly debased. Many ordinances for the administration of the government were left by him, and he was the first sovereign to convene and consult the states-general.

Philip V, surnamed *The Tall*, King of France, born in 1294; died in January 1322. He was the elder brother of Louis X, whom he succeeded in 1317. His reign was characterized by few noteworthy events.

Philip VI, of Valois, King of France, born in 1293; died near Chartres Aug. 22, 1350. He was the younger brother of Philip IV and succeeded Charles IV in 1328, but his right to the throne was denied by Edward III of England, grandson of Philip IV. Edward III claimed the throne of France by his mother, who was the sister of Charles IV. Philip was supported by the people of France, and the beginning of his reign was

PHILIP

full of promise, but Edward III declared war against him in 1337. This war was the beginning of a contest that waged for a period of 100 years and was finally terminated by the French victories under Joan of Arc. The first important event of the war was the destruction of the French fleet off Sluis in 1340. Normandy was captured in 1346 by Edward, who later marched upon Paris, but after the French defeat at Crécy a truce was concluded. France later became embarrassed financially as a result of official extravagances, and the people succeeded in their demands to vest the exclusive power to tax in the assembly of the states. Philip was regarded as unfriendly to learning, irrational in dealing with the Jews, and exorbitant in his exactions of revenue. He was succeeded by his son, John the Good.

Philip, the name of five kings of Spain; the two most important are treated in articles below. *Philip I*, King of Castile and Aragon, the son of Emperor Maximilian I, was born at Bruges on July 22, 1478; died there Sept. 25, 1506. *Philip III*, King of Spain, son of Philip II, was born at Madrid on Apr. 14, 1578; succeeded his father on Sept. 13, 1598; and died at Madrid on Mar. 31, 1621. *Philip IV*, King of Spain, son of Philip III, was born at Valladolid, Apr. 8, 1605; succeeded to the throne on Mar. 31, 1621; and died on Sept. 17, 1665.

Philip II, King of Spain, son of Emperor Charles V and Isabella of Portugal, born at Valladolid, May 21, 1527; died in Madrid, Sept. 13, 1598. His mother died when he was 12, but he was carefully educated for political duties under the direction of his father. He married Mary of Portugal in 1543, who died two years later, leaving a son, Don Carlos. He was summoned to Brussels by his father in 1548, that he might become acquainted with the people and institutions over which he was to become ruler, and in 1554 married Queen Mary of England. The same year his father waived his claim to Naples and Sicily in favor of Philip, and in 1555 gave him sovereignty of The Netherlands.

In 1556 the crown of Spain passed to him, and with it the colonial possessions in America, Asia, and Africa. Queen Mary died in 1558 and it was Philip's purpose to marry Elizabeth, who had succeeded to the throne of England, but although that lady did not reject the proposal at once, she adopted a policy in religion that would have made such a union impossible. Changing his plans, Philip married Isabella of France in 1559, and soon after settled permanently in Spain. His religious policy was rigorous, and it was his design to become recognized as the head of the Catholic party in Europe, for which purpose he suppressed the free institutions that had long prospered in many parts of his vast dominion. The Netherlands revolted in 1566 and, after a successful con-



PHILIP II

flit, established the Dutch Republic by uniting seven of the northern provinces. This contest was carried on under the leadership of William the Silent for many years, but Philip instigated the assassination of William in 1584. He was married a fourth time in 1570 to the Archduchess Anne of Austria.

The military forces of Philip II conquered Portugal in 1580, when he annexed that country to his dominion and immediately began to build the Invincible Armada to further his plans by overcoming the naval forces of England. The war began in 1587, but The Netherlands remained hostile, while the Turks engaged a portion of his forces. The only naval victory gained in the war was that of Lepanto, which was won over the Turks by Don John of Austria. (See G.K. Chesterton's narrative poem, "Lepanto.") His Armada was scattered by storms and eventually was totally defeated by the allied forces of England and The Netherlands. These disasters caused Spain to lose its proud position as a first-class naval power. In the meantime financial distresses accumulated and many Spanish colonies asserted their independence. Peace with France was finally concluded at Vervins in 1598. However, hostilities with England and The Netherlands continued and he died before the war terminated. Philip possessed con-

siderable ability. He was the originator of many vast enterprises and was popular with the zealous, but his plans were seldom successful. It was his fixed policy to persecute vigorously his opponents and those differing from him religiously by employing the Inquisition. Historians generally unite in rating him as austere, cold, and bigoted. He was succeeded by his son, Philip III.

Philip V, King of Spain, first of the Bourbon kings, born in Versailles, France, Dec. 19, 1683; died in Madrid, July 9, 1746. He was the Dauphin Louis, son of Louis XIV of France, and in 1700 became King of Spain, succeeding to the throne by the will of Charles II, who died without direct heirs. In 1702 he married Mary Louisa and in the same year the War of the Spanish Succession was begun. This conflict was caused by his rival claimant to the throne, Archduke Charles of Austria, who was supported by the allied forces of Austria, Holland, and England, while Spain, a portion of The Netherlands, and Naples sided with Philip. The war was finally terminated in 1713 by the Peace of Utrecht, by the terms of which Minorca and Gibraltar were ceded to England; Naples, Milan, and The Netherlands to Austria; and Sicily to Savoy, but the other Spanish possessions recognized him as king. His queen having died, he married Elizabeth Farnese, niece of the Duke of Parma, in 1714, who began immediately to exercise much influence in the government. It was her desire to expel the Hapsburgs from Italy, that her sons of a former marriage might secure possession, a wish which for many years disturbed the peace of Europe. In 1727 an alliance was formed by Spain, Holland, France, and England against Austria, whose emperor was then in possession of most of Italy, and in 1731 Spain recovered some of its Italian possessions. In 1736 the two sons of the Spanish queen secured the throne of the two Sicilies, but these advantages were lost soon after. Philip reigned 46 years. Many useful reforms were made in the period, including the establishment of schools, the improvement of the navy, and the founding of libraries. He was succeeded by his son, Ferdinand VI.

Philip the Bold, Duke of Burgundy, son of John the Good, born Jan. 15, 1342; died Apr. 27, 1404. He was the last of the ducal house of Burgundy. After securing a military training, he displayed heroic courage at the Battle of Poitiers, in 1356, where he saved the life of his father and earned the title of *The Bold*. Both he and his father were taken as prisoners to England, but in 1360 he returned to France, where he was rewarded for distinguished services by an assignment of the duchy of Touraine, to which the duchy of Burgundy was added in 1363. He lost Touraine when Charles V became King of France, but later obtained Flanders by marrying the

heiress, Margaret. In 1372 the French army was placed under his command, with which he secured many of the English possessions, and when his nephew, Charles VI of France, became insane, he was made regent. Philip not only displayed military genius, but he encouraged commerce, manufactures, and arts. A number of flourishing schools were established and fostered under his direction. His regency of France was both wise and successful.

Philip the Good, Duke of Burgundy, son of John the Fearless, grandson of Philip the Bold, born at Dijon, June 13, 1396; died at Bruges, July 15, 1467. His father was assassinated through the instigation of the dauphin, afterward Charles VII, at the bridge of Montereau, and he succeeded him as Duke of Burgundy in 1419. It was his desire to avenge the death of his father, and accordingly he placed himself in an offensive and defensive alliance with Henry V of England. This king recognized him as heir to the throne after the death of Charles VI. Later he was recognized as heir by the King of France and the states-general in the Treaty of Noyes, concluded in 1520, though this agreement was not in accord with the Salic law. However, the dauphin refused to recognize the treaty, and accordingly gathered a military force to assert his claims. He was defeated at Crevant in 1423 and again at Verneuil in 1424, but a dispute between Philip and the English caused the former to conclude a treaty with the French king in 1429. Afterward a second dispute arose between Philip and the English, when he was aided by the King of France in expelling the English from their possessions in France. Philip now became devoted to the encouragement of industrial and educational arts, for which purpose he devised a system of general taxation, and his reign was one of the most efficient and prosperous in Europe. Heavy taxation caused an insurrection in Ghent and Bruges in 1454, but it was suppressed by Philip with much ability. Burgundy was the most wealthy state of Europe during his reign, and his subjects generally mourned his death.

Philippi (*fil-īp'i*), ancient city of Macedonia, named after Philip II of Macedonia. Its historical importance dates back to 42 B.C., when Augustus and Antony, in a second battle, defeated the republicans under Brutus and Cassius. (See Shakespeare's "Julius Caesar.") Philippi was also the site of a Christian church built by the apostle Paul, who here delivered one of his epistles to the Christians.

Philippics (*fi-līp'pīks*), a name originally applied to a series of celebrated orations spoken by the Greek orator, Demosthenes, against Philip, King of Macedon, father of Alexander the Great. The number of orations is usually given as three. Their special purport was to arouse the Athenians

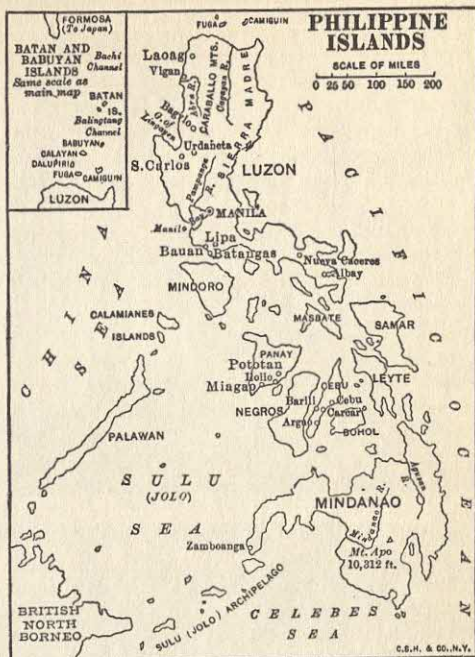
PHILIPPINES

for defensive organization against the growing power of Macedon. The name was afterward applied to 14 orations delivered by Cicero against the dangerous and malicious designs of Mark Antony, and it has since come to signify any severe written or oral invective.

Philippines (*fī'lī-pēnz*), REPUBLIC OF THE, OR PHILIPPINE ISLANDS, a group of islands in the Malay Archipelago, situated southeast of Asia, including over 7,000 islands and islets. The total area is about 115,600 sq. m. Many of the islands are small and comparatively worthless, but as a whole the group possesses remarkable richness in natural resources. The principal islands, in the order of size, are Luzón, Mindanao, Sámar, Negros, Palawan, Panay, Mindoro, Leyte, Cebú, Bohol, Masbate, and Roblón. Twenty-one other islands are of moderate size, ranging from 100 to 250 sq. m.

DESCRIPTION. The islands are of volcanic origin and are a part of the vast oceanic plateau which is partly elevated above the surface of the sea. They are surrounded by comparatively shallow waters, which exceed a depth of 200 ft. only in a few places. The surface is diversified by mountains, thus making a large part of the area not inhabitable and tending to centralize the inhabitants in the more fertile parts. In general the ranges extend from south to north, showing the outlines of a continuous mountain system that formerly towered at great elevation above the sea. The highest peaks approximate 10,000 ft., but Mt. Apo, in Mindanao, the culminating summit, is 10,312 ft. high. Between the mountains are narrow plains, which broaden somewhat near the coast. Most of the highlands are near the interior of the islands and slope toward the coast, but Leyte has no elevated mountains. Only a few of the volcanoes are active at present, though more than 20 have had eruptions within the historical period, and fully 50 have well-marked volcanic characteristics. The coast lines are generally irregular and afford excellent harbors. Earthquakes have been frequent and in some cases destructive.

The rivers are short and rapid. Mindanao, one of the largest islands, has two rivers of considerable length, the Agusan and the Pulanqui. The former flows north into the Surigo Sea, while the latter has a course toward the southwest into Lake Liguasan, whence it flows toward the northwest into Illana Bay. The Cagayan or Rio Grande drains the northern part of Luzón. In the southern part of that island is the Pásig, which unites Laguna de Bay with Manila Bay. This stream is important for commercial enterprise, affording transportation facilities from Manila, on Manila Bay, to Pásig, Santa Cruz, and other ports on Laguna de Bay. A number of the streams are used for irrigating purposes in regions where the rainfall is insufficient. Luzón has two lakes of con-



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siderable size, Laguna de Bay and Bonbom, or Taal, both being fed by numerous springs and streams. Mindanao has a number of lakes, including Lanao, Liguasan, and Buluan. Mindoro, Leyte, and Sámar have many small rivers, but the lakes are not important.

The Philippines are located within the tropics, and the climate is diversified, owing partly to variations in altitude and area, and partly to the predominating influence of prevailing winds. Three seasons mark the year more or less distinctly. These include the temperate and wet from July to October, the temperate and dry from November to February, and the hot and dry from March to June. In some sections the rainfall is constant and heavy in July and August, reaching about 114 in. in various localities. Along the eastern coast the precipitation is not excessive, being shut off to some extent by the mountains. The temperature ranges from 61° to 97° during the year, though in July and August it remains almost stationary between 79° and 85°. In May the temperature ranges from 80° to 100° F. in the shade, and the coolest month is December. Terrible storms sweep across the islands at intervals. They are cyclones of wind and rain, known as typhoons, but occur most frequently in the northern section, where life and property are frequently endangered.

FLORA AND FAUNA. The islands are rich in vegetable life, which assumes varied and distinctive tropical luxuriance. Valuable forest trees abound in different sections of the archipelago, including the ebony, ipil, narra, tindalo, yakal, teak, cama-



EVERYDAY LIFE IN THE PHILIPPINES

The industries of the Philippine Republic are varied. Some are of long standing, for instance, the production and processing of Manila hemp, or abacá, here (*above left*) drying in the sun; and others are of fairly recent introduction, for example, the manufacture of textiles (*above right*). Reminiscent of earlier days is the basketmaker shown at left; his baskets are now used to carry vegetables to city markets. The day-to-day government of the republic is carried on from the 49 provincial capitals. The largest of these is Cebu City, capital of Cebu Province. The city is the commercial hub of the central Philippines, in the island group known as the Visayas. Cebu's capitol (*below*) was built in 1937 and carries below its dome the following inscription: "The authority of the government emanates from the people" (*all photos on this page, courtesy Shell Photographic Unit, London, England*)





MANILA

The waterfront on the Pásig River (*top*) is in the central part of the city; the general post office is at the *left*. Landmarks of Manila are the Rizal Monument (*above*), dedicated to José Rizal (1861-96)—a Malayan who became a national hero through his novels, which disclosed the conditions of life under the Spanish, and who was executed by the Spanish — and the ruins of Lourdes Church (*right*), bombed out in World War II. A new Lourdes Church was later built in Quezon City (*courtesy Philippine Assn., Inc.*)



gón, and lauan. Some of the trees are so hard that they are cut with difficulty, and this class of timber is exceptionally valuable for furniture and shipbuilding. There are about 615 varieties of trees and some 40,000,000 acres of commercial forests, largely government-owned, which furnish wood for building and cabinet purposes, and gums and resins. Some localities are interlaced and garlanded by many species of shrubs and vines that are common in tropical regions. Blossoms and fruit are found hanging together on the trees in the cultivated fields and the yield of crops of this kind is in constant succession. Hemp is the best-known product of the Philippines and the name manila is generally applied to the commodities made from it, such as twine, rope, and paper.

Few native mammals are found. The carabao, or water buffalo, is the most important animal, and is valued for its flesh and as a beast of draught and of burden. Carabao milk is used to make ice cream and cottage cheese. It is thought that the humped variety of cattle is native. Other native animals include crocodiles, civet cats, monkeys, and reptiles. Many species of birds of song and plumage abound, and huge spiders and tarantulas are very common. Among the birds are the snipe, jungle fowl, curlew, pigeon, hornbill, and humming birds. Oysters, shrimps, crabs, and numerous species of fish are plentiful. A profitable shell fishing and pearl industry has been developed.

MINING. The islands have an abundance of mineral wealth, much of which has been known for centuries, although the developments are only of comparatively recent date. Coal is found in large fields in the principal islands and gold is mined in Luzón and Mindanao. Copper is found in the northern part of Luzón and iron occurs in Cebú, Luzón, and Panay. The volcanic regions are rich in sulfur and many localities have deposits of salt and gypsum. Silver occurs in connection with lead. Other minerals are quicksilver, saltpeter, arsenic, petroleum, and natural gas. Granite and limestone suitable for building purposes are abundant.

AGRICULTURE. Before World War II, the leading industry was agriculture, and about 60 per cent of the land was suitable for cultivation. Farming implements and methods were inferior until the islands became a possession of the U.S., when farm machinery and modern farming methods were introduced. Agriculture is confined almost entirely to the region elevated less than 700 ft. above the sea. Nearly all the cultivated plants common in Southeastern Asia thrive. About 5,000 native species of plants have been classified by botanists, showing that the flora is very extensive. The greater part of the farming land is owned by native Filipinos whose farms average about three acres each. Manila hemp, or *abacá*, is

considered one of the most valuable of the native plants. Luzón had the largest area of tilled land before the war, while Masbate possessed the most extensive interests in livestock. Rice, unhusked and called *palay*, was the staple crop, followed by the yield of sugar, which is obtained chiefly from sugar cane. Tobacco had a high rank, both in quality and yield. Other products included manila hemp, coffee, cotton, chocolate, rubber, coconut, corn, and cacao. The tropical fruits are abundant, especially the pineapple, banana, orange, mango, lemon, and pomegranate. The islands lead in the production of copra and coconut oil.

The livestock industry has been centered largely in cattle raising, although carabaos (water buffalo) outnumber the cattle. Horses are reared quite extensively, but the grades are small, ranging between the pony and the saddle horse. Cattle with a small hump are grown for beef, and swine and poultry are favorite animals among the natives. The government introduced alfalfa as a means of encouraging the livestock industry and it has been found a highly profitable product. Goats and sheep were introduced by the Spaniards and are grown in small herds.

MANUFACTURES. Philippine industry has remained largely in the homes, but the number of factories was on the increase before World War II. Cloth was the leading manufactured product. A large quantity of mats, carpets, hats, and rugs were made of strip bamboo. Cordage made of hemp was produced extensively, both for domestic use and for exportation. Pipe tobacco and cigars were manufactured extensively, for which purpose modern machinery was introduced. Other manufactures included salt, confectionery, pottery, saddlery, brick, and furniture. Lumber was exported in considerable quantities. A large number of small vessels were made, for coastwise transportation.

TRANSPORTATION AND COMMERCE. The islands had about 570 m. of railways in operation in July 1946. The most important line was operated in the western part of Luzón, extending from Manila to Lingayén. In general, railroads were constructed from the coast to the interior rather than lengthwise on the larger islands, since coastwise transportation was handled mostly by steamers. Highways of a superior grade were constructed, and on July 30, 1946, included 15,053 m.

The exports somewhat exceeded the imports, and the foreign trade was largely with the U.S., Japan, Great Britain, China, Canada, Australia, France, and Spain. Manila hemp was the most important export and it was followed in order by sugar, tobacco, lumber, and fruits. The imports included cotton textiles, flour, glass, liquors, and machinery. The three leading ports were Manila,



Courtesy Canadian Pacific Steamships

NATIVE HUTS AT GUADALUPE

Cebu, and Iloilo, but custom houses were maintained also at the ports of Aparri, Jolo, and Zamboanga. In 1952, imports totaled \$426,000,000, and exports totaled \$348,000,000.

POPULATION. The Filipinos belong to one racial stock, the Malays, blended with Indonesian, and later with Mongoloid, elements. Christians number more than nine-tenths of the population, Mohammedans a little over 4 per cent. Other religions account for slightly under 4 per cent. Roman Catholicism was introduced by the Spaniards and is the predominating religion, having about 80 per cent of the population among its followers, but the leading Protestant denominations have secured a considerable number of followers through missionary work. Many of the natives in the Sulu Islands are Mohammedans, and the Buddhist faith is represented in some sections. Some of the wild tribes in the south conduct a form of pagan worship.

Manila, in the southwestern part of Luzon, is the metropolis, chief seaport, and administrative center of the government. It was the Philippine capital until Quezon City, not far from Manila, was designated (1948) as the official capital of the republic. Other cities of importance include Cebu, Iloilo, Baguio, Zamboanga, Davao, Bacolod, Tagaytay, San Pablo, Cavite, and Dansalan. Luzon is the most populous island, but Cebu has the largest number of inhabitants to the square mile. In 1922, the population of the islands was 9,935,426; in 1952 (est.), 20,631,000.

LANGUAGE AND LITERATURE. About six principal dialects are spoken in the archipelago, but the number is much larger if all of the local variations are taken into account. Some of the languages are primitive and crude, while others show a high degree of precision and culture. At

present the tendency is to unify and develop the leading languages at the expense of the others, and English is taken up readily by the younger groups. The leading dialects include Tagalog, Visayan, Ilokano, Bikol, Pampango, and Pangasinan. In December 1937 Tagalog was made the basis of the national language.

When the Spaniards occupied the Philippine Islands, in 1521, they found the Filipinos possessed a well-advanced culture of their own. The ancestors of the present Christian population wrote their dialects in syllabaries of Hindu origin, while the Mohammedan peoples of Mindanao and Sulu were beginning to use Arabic characters, in which their literature is still preserved. The early Spanish missionaries taught the people to use the Roman alphabet in place of the native syllabaries. In this way, ability to read and write the native dialect was spread over a wide area.

EDUCATION. The 1903 census found *ca.* 1,000,000 people able to read and write in a native dialect. About 1863 the Spanish government made the first public provision for primary instruction, Town schools for both sexes were established, and provision was made for training Filipino teachers. This work progressed steadily, although slowly, until the close of the Spanish rule, when nearly every Philippine town had at least one primary school for each sex. The instruction was sometimes in Spanish, but more often in the native dialect.

After the American occupation, in 1898, a comparatively comprehensive public-school system was organized.

Today, a public-school system modeled on that of the U.S. provides free elementary and high-school education. In 1950-51 there were 22,077

public schools, with a total enrollment of 4,113,870 in all grades. The 11 universities include the Univ. of Santo Tomás, the Philippine Women's Univ., National Univ., and the Univ. of the Philippines (a state-supported institution which in 1948-49 had a registration of 7,106). The Philippine Medical School, established by the national government, was opened in 1907 and later became part of the Univ. of the Philippines. The large National Library at Manila has branches in other cities.

Under the Spanish regime higher, or superior, instruction was in private hands, though in certain cases it was aided by the government. Schools were established by the sons of Spanish colonists within the first decades after the conquest. In 1601 the Jesuits established in Manila the Coll. of San José. The Dominican Order founded the Coll. of Santo Tomás in 1611. This subsequently became the Royal and Pontifical Univ. of St. Thomas Aquinas. Provision was early made for the training of Jesuit priests, who were sons of both Spanish colonists and Filipinos. In the last century of the Spanish rule there were seminaries in each episcopal diocese. One important institution established by the Jesuits after their return to the islands was the Ateneo de Manila.

GOVERNMENT. Until July 4, 1946, the government of the Commonwealth of the Philippines was administered under U.S. protection. In 1916 the legislative authority became vested in the Philippine legislature, composed of two branches, one the senate and the other the house of representatives. The senate consisted of 24 senators and the house of representatives of 90 members. The legislature created under this law opened its first session on Oct. 16, 1916, and on its being organized, the former Philippine commission ceased to exist. Judicial authority is vested in the supreme court, the courts of first instance, and the municipal courts, but all important causes are subject to review by the supreme court. A unicameral legislature was provided by the permanent constitution ratified in 1935; in 1940 it was amended to restore the bicameral legislature, the house to consist of not more than 120 members and the senate of 24 members, and to set the term of office of the president and the vice president at four years each. This arrangement follows the terms of the Tydings-McDuffie Act passed by the U.S. Congress in 1934, which provided for the independence of the islands in 1946. On July 4, 1946, the Commonwealth became the "Republic of the Philippines," an independent state (see **HISTORY** later in this account).

Executive power is vested in a president, who is elected by qualified voters through direct ballot once in four years. Assisting the president are ten departmental secretaries. Legislative power is vested in a congress, which consists of two cham-

bers: the senate, with 24 members elected for six-year terms; and the house of representatives, with 100 members elected for four-year terms. The republic is composed of 51 provinces.

The government requires ten months of military training of men aged 21 to 50. The total defense force (1951) numbers some 54,000, including army, navy, and air personnel.

The unit of currency is the peso, for which see *Coinage*.

HISTORY. The Philippines were discovered in 1521 by Magellan, who visited many parts of the Visayan islands and in the same year lost his life in a war on the island of Cebu. Spain immediately began to promote colonization of the islands, but a permanent settlement was not founded until 1565, when a colony was planted on the island of Cebu. Although the islands had been claimed for Spain in 1521, not all of the islands had been conquered even by the end of Spanish rule in 1898. Manila was founded in 1571 and was made the seat of government. Christian missions were established soon after in a number of the islands. The Chinese invaded the archipelago in 1574 and almost succeeded in destroying Spanish influence, which was likewise threatened by the Dutch. During the 18th century the islands remained in the hands of the Spanish, except when they were captured by the British during the Seven Years' War, but they were restored to Spain in 1763 by the Treaty of Paris. The cultivation of tobacco as a government monopoly was introduced in 1780, in an attempt to make the colony self-supporting.

Spain remained in undisputed possession of the islands, except for a number of attempts to establish a native independent government, until the beginning of the Spanish-American War, in 1898. The last armed resistance against the Spanish had been organized in 1896, under the leadership of Andres Bonifacio, later of Emilio Aguinaldo and other native leaders. This insurrection had been subdued after a desultory war of nearly two years, and Spain was to pay the leading malcontents the sum of \$400,000, but only half of this sum was ever paid. This caused the insurrection to break out again in April 1898, and Aguinaldo held a conference with Consul-General Pratt, the U.S. representative at Singapore, and it was agreed that he should cooperate with Com. Dewey, who was in command of a fleet. Aguinaldo received a supply of arms from Com. Dewey for the insurgents, who promptly rallied to the support of their leader. The Spanish fleet was destroyed at Manila on May 1, 1898, and many points inland were occupied. The Treaty of Paris ceded the islands to the U.S., but Spain received a cash amount of \$20,000,000.

A dispute between Aguinaldo and other leaders of the insurrection against Spain now arose with



PHILIPPINE INDEPENDENCE CEREMONY, JULY 4, 1946

the American authorities because of a misunderstanding. The Filipinos had organized a government and adopted a provisional constitution, and Aguinaldo appealed to the nations for the recognition of the independence of the Philippines. A revolt, known as the Filipino Insurrection, against American authority, began in February 1899, when hostilities broke out at Manila. This was followed by an intimation that the U.S. would annex the islands. Three and a half years were consumed in subduing the opposition, and much expense and bloodshed were involved.

President McKinley had sent a commission to the islands in January 1899, for the purpose of investigating the conditions and endeavoring to induce the natives to accept American rule. This commission issued a proclamation to explain the intentions of the government and proceeded to organize a party favorable to the Americans. Little progress was made by the American army until the latter part of 1899, when the native army was driven to the mountains, where guerrilla warfare was conducted for some time. Aguinaldo was captured in March 1901, but the insurrection was not officially ended until July 4, 1902. The government throughout the war was military, but large districts were soon pacified, and civil government was established. The cost of the war to the U.S. was about \$175,000,000. William H. Taft was at the head of the Philippine administration from 1900 until 1904, when he was succeeded by Gen. Luke E. Wright. Frank Murphy was the last American governor-general of the Philippines. Manuel Quezon was elected in 1935 as first president of the Commonwealth of the Philippines under the constitution adopted in that year. In July 1941 the Army of the Philippines was incorporated into the U.S. Army under the command of Gen. Douglas MacArthur (*q.v.*). The Philippine Army of over 100,000 men and the Philippine Scouts of 12,000

men, together with some 19,000 American troops, were the sole defense of the Philippines against the Japanese in 1941.

During World War II, the Philippines were attacked by Japanese planes on Dec. 7, 1941. This attack was followed by an organized invasion begun on Dec. 10, 1941. Attacked by numerically superior forces, the defenders under Gen. MacArthur had to give way slowly; Manila, declared an open city on Dec. 26, fell on Jan. 2, 1942; the Cavite naval base on Jan. 2, 1942. By April 10, 1942, the Japanese had forced the defenders to surrender Bataan Peninsula and to withdraw to the island fortress of Corregidor. The latter was held until May 6, when exhaustion forced the commander, Gen. Jonathan Wainwright (*q.v.*), to surrender. The recapture of the Philippines commenced with the first battle of the Philippine Sea (June 1944). The second battle, which the U.S. Navy termed one of the most decisive victories of the war, was fought in October of the same year. On Oct. 20, 1944, Gen. MacArthur returned, and American forces quickly occupied Leyte Island. Manila fell in February 1945. The Philippine campaign continued through the summer until each island was freed from the Japanese invaders.

In fulfillment of a pledge of long standing, the U.S. proclaimed the independence of the "Republic of the Philippines" on July 4, 1946, and U.S. forces were gradually withdrawn from the Philippines. However, the two countries continued their time-honored ties of trade and cordial relations. A 99-year mutual defense treaty, signed in 1947, provided for the establishment of American military and naval bases on the islands.

Manuel Roxas was elected the first president, and upon his death Vice President Elpidio Quirino succeeded to the presidency (April 17, 1946). He was returned to the presidency for a four-

year term in the 1949 general election. Ramón Magsaysay was elected, Nov. 10, 1953, to succeed Quirino, whose administration aroused much controversy and charges of corruption. Magsaysay's administration sought to improve the government services, eliminate corruption, and suppress the Hukbalahap movement. The Huks, as these Communist-supported guerrilla fighters were called, had harassed the government since the end of the war with raids and violence. Outlawed in 1948, the Huks continued their activities until a relentless government military campaign wiped them out almost completely. In 1954 the Huk leader, Luis Taruc, was taken prisoner, and thereafter only minor guerrilla activity occurred.

Magsaysay died in an air crash on March 17, 1957, and was succeeded by Vice Pres. Carlos P. Garcia. In November 1957 Garcia (Nationalist party) was elected president, and Diosdado Macapagal (Liberal party) vice president. Garcia's term was not a very successful one, and he lost his campaign for re-election (1961) to his vice president. Macapagal waged his campaign on the issues of corruption in government, economic woes, the government's inaction to alleviate the problem of poverty (especially in rural areas), and a promise of promoting a free enterprise system.



Wide World Photo

DIOSDADO MACAPAGAL

Standing behind microphone, he is sworn in as the fifth president of the Philippines by Chief Justice Cesar Bengson

As a charter member of the U.N., the country has taken active part in the deliberations of the organization and the Philippine's chief delegate, Gen. Carlos P. Romulo (*q.v.*) was elected president of the U.N. General Assembly (1949). In international matters, the Philippine government usually supports the U.S. and in 1954 signed the Manila Treaty (*q.v.*).

Philippopolis (*fil-i-pöp'ô-lis*) or PLOVDIV, a city in southern Bulgaria, on the Maritsa River,

about 82 m. s.w. of Sofia. It is the capital of the department of Plovdiv, and is an important trading center, dealing extensively in attar of roses, wheat, tobacco, silk, and beer. In ancient times the town was first called Eumolpias; in 342 B.C. it was taken by Philip II of Macedon and renamed after him. Under Roman administration it was made the capital of Thrace. It was ruled by the Turks from A.D. 1317 until 1878, when it became capital of the autonomous province of Eastern Rumelia. Since 1885 the city has belonged to Bulgaria. Population, 1950 (est.), 127,000.

Philipse Manor (*fī'lips mā'nôr*), an estate extending from Yonkers, N.Y., to North Tarrytown, between the Hudson and Bronx rivers. It was originally acquired by Frederick Philipse (1626-1702), a Dutch merchant, who built a manor hall in Yonkers and Philipse Castle in North Tarrytown. The manor hall was used as the Yonkers town hall (1868-1908). Both the hall and the manor are open to the public, and their displays are fine examples of Colonial life.

Philistines (*fi-lis'înz*), a people formerly resident in the lowlands of Palestine, on the Mediterranean coast, occupying the region from near Joppa to the Egyptian desert south of Gaza. They are mentioned in the Bible as coming in conflict with the Israelites in the age of the Judges and are spoken of as a warlike colony at the time of the Exodus. Their territory consisted of five principal cities or provinces: Ashdod, Askelon, Ekron, Gath, and Gaza. In the time of Eli they overwhelmed the Israelites, when they captured the ark. King Saul died fighting the Philistines in the battle of Mt. Gilboa. David and Solomon fought against them and the latter finally annexed their territory, but later they were emboldened by the internal strife of Judah and again rebelled against Israelitic supremacy.

In the reign of Ahaz the Philistines formed an alliance with the Syrians and Assyrians, to harass the Israelites, but their whole country was again subjected by Hezekiah. The writings of the prophets make it certain that they were a menace to the Jews, but it is reasonable to assume that at different periods intermarriages and social connections between the two nations were of common occurrence. They appear to have been a civilized people, devoted to agriculture and commerce, and possessing more than ordinary skill in warfare. Residing near the Mediterranean, they developed a considerable trade in manufactures. In later times their country became merged into Palestine, and all traces of their former dialect were lost.

Phillips (*fī'lips*), WENDELL, orator and abolitionist, born in Boston, Mass., Nov. 29, 1811; died there Feb. 2, 1884. He was descended from a wealthy family and in 1831 was graduated from Harvard Univ., where he was a classmate of

Charles Sumner and J. L. Motley. After his graduation from Harvard, he entered the Cambridge Law School, where he studied under Justice Story and, in 1834, was admitted to the bar.

Phillips was successful in his practice from the first because of his extraordinary oratorical ability. In 1837 he witnessed a mob making an assault on William Lloyd Garrison, who had spoken in Boston in favor of the emancipation of the slaves, and was so forcibly impressed that he entered upon a careful study of the slavery question. He was soon denounced as an abolitionist and began to arouse public sentiment by advancing unanswerable arguments against slavery, which persuaded a large number of people to join in the movement for the liberation of the slaves. His first great address on this subject was delivered at Faneuil Hall, Boston, in 1837, when he denounced the murder of E. P. Lovejoy at Alton, Ill., by sympathizers of the slaveholders. This course caused many of his clients to abandon him, and his practice was almost ruined. However, he received an inheritance from the estate of his parents, which enabled him to devote himself to the antislavery cause and to lecture on other subjects.

Phillips favored the political equality of women. He opposed the annexation of Texas, the Mexican War, and the Compromise of 1850. He favored the separation of the free and slave states until Ft. Sumter was fired upon, when he began to advocate the destruction of slavery by the defeat of the Confederacy. After the Civil War he became a leader of the Labor party and was one of the organizers of the Greenback party.

Phillips Andover Academy (*an'dō-vēr*), a nonsectarian private college preparatory school for boys in Andover, Mass., founded in 1778 and incorporated in 1780. It was conceived and

planned by Samuel Phillips, judge and politician, who was born in North Andover Feb. 5, 1752, and died in Andover Feb. 10, 1802. The school is commonly called Andover, to distinguish it from Phillips Exeter Academy (*q.v.*). Among its graduates have been Samuel F. B. Morse, Oliver Wendell Holmes, and Josiah Quincy.

Phillipsburg (*fil'ips-bürg*), a town in northwestern New Jersey, on the Delaware River, opposite Easton, Pa. It is on the Central R.R. of New Jersey, the Pennsylvania R.R. and others, and is about 40 m. n.w. of Trenton. Manufactures include iron pipes, cement, textiles, machinery and chemicals. The surrounding region is agricultural and contains productive deposits of limestone and iron ore. Phillipsburg was settled in 1749 and incorporated as a town in 1861. Population, 1940, 18,314; in 1950, 18,919.

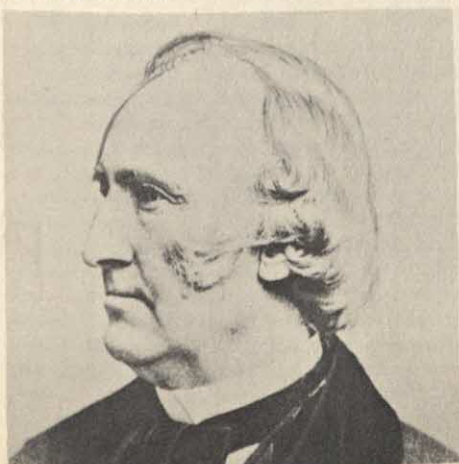
Phillips Exeter Academy (*ēk'se-tēr*), a nonsectarian, private, college preparatory school for boys in Exeter, N.H., founded in 1781 by John Phillips, merchant, who was born in Andover, Mass., Dec. 27, 1719, and died in Exeter, April 21, 1795. He was the uncle of Samuel Phillips, one of the founders of Phillips Andover Academy (*q.v.*).

Philoctetes (*fil-ōk-tē'tēs*), in Greek legend, a warrior of the Greek army in the Trojan War, to whom the dying Hercules bequeathed his bow and arrows. On his way to Troy, Philoctetes was bitten in the heel by a serpent and left to die on the island of Lemnos. After many years, however, it was revealed by a seer that Troy could not be taken without the bow and arrows of Hercules. Accordingly Philoctetes was brought to Troy and healed there. Later, he killed Paris. The story of Philoctetes is the subject of a drama by Sophocles.

Philo Judaeus (*fi'lō jōō-dē'ūs*), Jewish philosopher, born in Alexandria, Egypt, about 20 B.C.; died about A.D. 50. He was descended from a wealthy family and received a liberal education in his native city. His natural ability was linked with an extraordinary desire to secure educational advancement, and he devoted constant attention to all the studies contained in the course of the great university in Alexandria. His writings indicate that he possessed a wide range of knowledge in philosophy and metaphysics. He contributed many valuable additions to history, astronomy, music, geography, mathematics, and other branches of learning. He made a visit to Rome in A.D. 40 to persuade Caligula to refrain from requiring the Jews to give up their religious views, and on this mission he was accompanied by a Jewish embassy.

Philo studied the writings of Homer, Plato, and other Greek writers, but he continued firm in the belief that the revelations through Moses

WENDELL PHILLIPS



are the source of true religion and that the philosophy of the Jews embodies the highest wisdom. Several of the fathers of the church record that he met the Apostle Peter on a second mission to Rome in the time of Emperor Claudius, though some think this is extremely doubtful. His writings indicate that he mastered the literature of his own people from translations, and that the Septuagint translation of the Bible was the only one with which he was acquainted. Writers have given us little information regarding the life of Philo, but the numerous writings from his pen that are extant enable acquaintance with his views of the universe and of life. By them it is possible to estimate his scientific and religious aim and to assign him the station to which he is entitled in the history of the growth and development of thought.

He is not only the most important Hellenic Jewish writer, but we learn from his writings the views held by this particular class of Jews, and what their aim was in the teaching of secular and religious themes. A student of philosophy and Mosaic law, he gave both a high position as branches to be studied, and it was his inclination to direct his thoughts toward harmonizing the two. In his discourse on religion he points to God as the source of all good and perfection and conceives him as being far superior to any of His creatures, His perfection assuming such magnitude that it cannot be realized. Philo not only holds the tenet that there is a future life for the blessed, but expresses a belief in the punishment of those who do not escape the temptations of sin. Many works are assigned to him, but some are thought to be spurious.

Philology (*fī-lōl'ō-jy*), the branch of study that treats of human language (*q.v.*). It traces the origin, development, and general structure of the different languages and involves all that speech discloses as to the nature and history of man. In Europe the word is generally understood to mean literary or classical scholarship, and in this sense *linguistics* (which is replacing *philology* as defined above) is only one of the tools used in the study of the culture of a people. The scientific investigation and comparison of the laws and principles of a language or a group of languages which have a common origin is usually called *comparative philology*. It is not the aim of the philologist to study languages so as to be able to read and speak them, but to examine them with scrutinizing care, and to bring the points of likeness and dissimilarity into convenient forms, that they may be classified and grouped. His task is to ascertain the basic laws and distinguishing features of languages.

Every discovery and invention, as well as every change in society, exercises a modifying influence upon the language of a people. Hence languages

are continually undergoing changes as certain words become obsolete, while newer terms spring into common use. It is possible for man to communicate without uttering sound, which is now the case with those who are deaf and dumb. It is likewise possible that written characters may be employed to convey knowledge to others even without employing vocal sounds. The latter method was utilized in placing hieroglyphics and written symbols on monuments and other durable forms for the purpose of conveying intelligence to future generations, since it is scarcely possible that a race ever existed which employed written characters exclusively to convey ideas among the living. Practically all employed both vocal sounds and written characters.

Some scholars feel that it is probable that in the beginning language originated largely from natural cries. This conception of the building of a language necessarily limits the early stage to a very small sphere, and as society developed and institutions were founded, language grew in complexity, reaching its highest stage in the highest civilizations. As a science, philology dates from a comparatively recent time. The Greeks were the only ancient people who gave the origin of language any consideration, but their development of the science was necessarily limited since they were acquainted with only their own language. The first advance in philological study was brought about when Sanskrit, the classical language of ancient India, was brought to the attention of European scholars, who observed a peculiar similarity between it and Greek. Franz Bopp (1791-1867), a German scholar, is the founder of study of the Indo-European languages, and he was followed by such eminent writers as the Grimm Brothers, Schlegel, and Wilhelm von Humboldt. It will thus be seen that the science dates practically from the early part of the last century. Since then many able writers have added a vast fund of information to the literature of the science.

Different classifications of languages are adopted by various writers. One classification recognizes three very general classes, the monosyllabic, the agglutinate, and the inflectional. The *monosyllabic class* embraces a group of languages spoken by the Tibetans, Siamese, Annamese, and Burmese. *Agglutinate languages* include those in which the word elements are so united as to retain their separate identity as modificatory syllables and, in some tongues, a part of their significative power as independent words. The words are not inflected when filling different offices, and suffixes are not added, but entire words are used in combination, as steamboat, mankind, and locksmith.

The *inflectional languages* are exemplified by two chief families, the Semitic and the Indo-

European. They are peculiar in that words are joined together and made into sentences, not primarily by means of a set of small secondary and auxiliary words, but by means of changes made in the main words themselves. Nouns, pronouns, and adjectives are inflected by declension, verbs by conjugation, and adjectives and adverbs by comparison. Fast, faster, fastest; love, loved, loving; and man, men, are familiar examples of inflection. The Semitic and Indo-European groups of languages are so different in their grammatical framework that it has been impossible for the science to establish a relationship among the different groups, though it is impossible to affirm or deny that both came from a common source. The Semitic languages include Hebrew, Arabic, Aramaic, etc. Leonard Bloomfield divides the Indo-European languages into the following classes: Greek, Celtic, Baltic, Slavic, Romance, Albanian, Armenian, and Indo-Iranian. English, although undeniably related to the Germanic languages, differs greatly from all of them. According to Bloomfield, English closely resembles the languages spoken by some 350,000 inhabitants of the coast and coastal islands of the North Sea, the so-called *Frisian* area, and "is an offshoot of an *Anglo-Frisian* (or *Ingweonic*) dialect area, which must have been fairly extensive before the migration to Britain." See also *Language*.

Philomela (*fil-ô-mē'là*), in mythology, a daughter of Pandion, King of Athens, and sister of Procne. She was loved by Tereus, who cut out her tongue that she might not expose the wrongs he did to her, but she wove the story of her wrongs into a mantle and sent it to Procne. Later the two sisters killed Itys, the son of Procne by Tereus, and served his flesh to his father for dinner. Tereus discovered the crime and pursued the sisters, but the gods turned them into birds. It is related that Tereus was changed into a hoopoe, while Procne became a swallow and Philomela a nightingale.

Philopoemen (*fil-ô-pē'mēn*), a patriot of ancient Greece, born at Megalopolis in 252; died in 183 B.C. He was descended from a prominent family of Arcadia, and lost his father at an early age, but was carefully educated under the direction of a wealthy citizen named Cleander. His first important military success was achieved in 222 B.C., when he took an active part against the King of Sparta. In 208 B.C. he advanced to the highest dignity in the military service of Greece by being elected commander in chief of the Achaean League, and was re-elected to the same place seven times. In that capacity he improved the discipline and armor of the Achaean soldiery and defeated Machanidas of Sparta and his successor, Nabis. Subsequently he carried on a military campaign in Crete, but was recalled to organize against the rise of Roman power, which began to

be an important factor in Eastern Europe against the Greeks. In 183 B.C. the Messenians broke their connection with the league, and he immediately headed a body of cavalry to quell the revolt, but was taken prisoner because of a defeat by overwhelming numbers, and, after being carried to Messene, he was compelled to drink a cup of poison.

Philosopher's Stone (*fil-ôs'ô-jēr-z stôn*), originally an idea in alchemy (*q.v.*) which gradually became the symbolic expression of a miraculous instrument which would discover the secrets of matter. Medieval alchemists, antecedents of the modern chemist, endeavored primarily not so much to build up a science as to discover the philosopher's stone, a mysterious substance which would be able to change specific metals into gold. Aristotle believed that metals did not represent a part of the ores but a permutation, so it was only logical that the medieval alchemists, following Aristotle in this respect as in so many others, tried to find the means to change other metals into gold and also to heal certain diseases. This mysterious instrument for which they sought they called "the Great Magisterium," or the Philosopher's Stone.

Philosophy (*fil-ôs'ô-fy*), literally the love of wisdom, has been traditionally regarded as the most inclusive and general study of the fundamental characteristics of all existence, with a view to furnishing a rational explanation of the flux of events and a sure guide for ordering human life. In the history of western philosophy, however, almost every type of theoretical inquiry was at one time included in philosophy, and nearly everything that today is investigated by one of the special sciences was for centuries assumed to fall within the province of the philosopher. Accordingly, while the love of wisdom was in principle the distinguishing mark of philosophers, they by no means neglected the pursuit of learning. For example, Aristotle, referred to by Dante as "the master of them that know," wrote extensively not only on matters that are still regarded as distinctively philosophical (metaphysics, logic, ethics, and aesthetics), but also on astronomy, physics, biology, psychology, politics, and economics. The 17th century found nothing strange in the fact that Newton entitled his great work on mechanics and the theory of celestial motions "The Mathematical Principles of Natural Philosophy"; and the phrase "natural philosophy" was still regarded as an appropriate name for their subject by eminent physicists as late as the second half of the 19th century.

However, as knowledge accumulated and special training and techniques became essential for cultivating different subjects, what were originally parts of philosophy gradually split off and formed independent special sciences. The most

recent of these departures from the mansion of philosophy is psychology; and a large part of logic is well on the way to being absorbed from philosophy into mathematics. Philosophy is thus the mother of many intellectual disciplines which, like many other offspring, have completely severed all bonds to their parent. In consequence, the content of philosophy has been gradually impoverished, and fears have been voiced that philosophy as a distinct branch of study is doomed to an early death. Philosophers are in fact deeply concerned over the question what the special task of philosophy is, and what distinctive subject-matter there is left for philosophy to explore.

THE TASK OF PHILOSOPHY. On this issue three major divisions of opinion can be distinguished. At one extreme there are those who believe that it is still philosophy's business to grasp the scheme of things entire, and to show that in spite of the apparent chaos there is a basic ground-plan in the world and a logical unity behind the flux of events. They maintain that philosophers have available a source of knowledge and a method which are distinct from those used by the special sciences. The sciences, it is claimed, deal only with limited aspects of existence, with things that are dependent for their existence upon other things, and with a shifting, insubstantial panorama of the world; philosophy, on the other hand, is directed to the whole of reality, to things which exist in their own right, and to the eternally constant basis of whatever exists. Physicists, for example, are said to make spatial measurements and to note the passage of time; but only philosophy can say what space and time *really* are. Moreover, the sciences are asserted to rest their conclusions on the data of sense observation, which are vague and unreliable; philosophy achieves its results through dialectic or a purified reason, which is precise and certain. Many who think this way go further, and draw a sharp distinction between reality and appearance—science and common-sense being concerned with the latter, while philosophy alone deals with the former. For it is reality which philosophy is said to seek—reality which is self-consistent and self-caused, as distinct from appearance which is shot through with contradictions and illusions. And many who think this way declare that reality cannot be grasped through ordinary logical thinking, but can be apprehended only through a mystic intuition which enables the individual thinker to lose his human finitude and to become identical with the divine source of all being.

At the other extreme are thinkers who believe that philosophy has seen its best days and hope for its rapid dissolution. They call attention to the fact that while in the sciences there is practically unanimous agreement concerning the results of inquiry, in philosophy there are conflict-

ing theories about the world with no recognized method for settling disputes. They point out that the sciences make progress because they build upon the results of past investigations, but that philosophy shows no growth because each philosopher feels free to ignore the work of his predecessors and contemporaries. They see in the great philosophical systems of the past only outmoded science—the outcome of the desire to fix for all eternity conceptions about the world which at one time may have been useful in scientific inquiry, but which have been abandoned as inadequate in the light of further research. Philosophers may pride themselves on dealing with ultimate questions, and on being occupied with the real natures of such things as infinity, matter, life, and the soul; but according to their critics, if the sort of answers that mathematics, physics, biology, and psychology give to such questions are dismissed by philosophers as irrelevant, it is only because they ask questions which are inherently meaningless. Philosophy, so it has been concluded, has therefore no distinctive subject-matter, and every intelligibly formulated problem with which philosophers have been concerned can be handled more successfully by the recognized methods of the sciences.

Philosophers who fall into the third division of opinion reject both of these extreme positions. They deny that philosophy can furnish knowledge of the world which cannot be supplied by the sciences, and they also reject the conception according to which the sciences deal only with the superficial (if not illusory) appearance of things, while philosophy is concerned with their ultimately real natures. But they maintain nevertheless that philosophy has a serious task to perform—one which is not undertaken by any of the special sciences, and one which traditional philosophy at its best has always performed. According to them, philosophy is criticism and the persistent attempt to think things through clearly. Its aim is to make men aware of the assumptions underlying their beliefs and actions, to evaluate these assumptions in the light of as wide a range of evidence as is available, to clarify the meanings of basic scientific distinctions, to bring to bear upon men's value preferences the full light of comprehensive knowledge, and to help men to order their lives without illusion and with full consciousness of their own powers and limitations. The business of philosophy, on this view, is the ancient one of pursuing wisdom. From this point of view, the great philosophical systems of the past must not be regarded as attempts at eternally valid accounts of the world; they must be understood as attempts at clarifying current claims to knowledge, and at incorporating into a coherent pattern the partial perspectives which special inquiries yield upon nature. Philosophy

is thus a reflection or commentary upon life and knowledge, not a first-hand report upon the ways of the world. Those who adopt this conception of the function of philosophy readily admit that many of the problems with which philosophers occupy themselves are strictly meaningless, and are often the sources of widespread intellectual and moral confusion. They also maintain that the futility of such philosophizing stems from the failure of philosophers to cultivate their proper business. This business is not that of legislating to the sciences, or attempting to plumb the secrets of the universe wholesale and by intellectual violence. This business is to analyze critically what commonly passes for knowledge, and to exhibit the bearing upon one another of the conclusions reached in various special inquiries.

MAJOR FIGURES AND SCHOOLS IN THE DEVELOPMENT OF PHILOSOPHY. Almost everything in Western (as distinct from Oriental) philosophy has developed out of the intellectual seeds planted by ancient Greek thinkers. According to a widely accepted opinion, philosophy began in wonder—wonder at the regular motions of celestial bodies, the ceaseless fertility of nature, and the intellectual and moral powers of man. The earliest thinkers of whom we have definite information (the *Pre-Socratics*, among whom are included *Thales*, *Heraclitus*, *Empedocles*, *Anaxagoras*, *Pythagoras* the geometer, *Parmenides*, and *Democritus*, the founder of the atomic theory of matter) engaged in speculations that were largely physical and cosmological. They sought to give naturalistic explanations for the behavior of things, and in the main they were severe critics of the anthropomorphic religions of their day.

However, the direction of philosophical thinking was turned toward ethical problems by *Socrates* (470-399 B.C.). According to Plato, his disciple and chronicler, Socrates opposed the moral relativism preached by the *Sophists* (itinerant teachers who offered training in oratory and other essentials for a successful public career in the Greek city-states), by urging upon the youth of Athens the need for clear definitions in matters affecting morals, and by teaching the identity of knowledge and virtue. *Plato* (428-348 B.C.) followed his master in this respect; but he also developed the notion implicit in the teachings of Socrates that true reality coincides with eternal Forms or Ideas, which are only imperfectly realized in the world of sense, and which must therefore be apprehended by minds especially trained to do so. In Plato's *Republic* he worked out his conception of the good life and of a system of education necessary to achieve it. These views of Plato have continued to be a potent influence upon subsequent thinkers; and his emphasis upon mathematics as the study for drawing the mind away from sensory things to the

eternal objects of contemplative reason, has controlled the organization of school curricula for centuries. Many of Plato's doctrines were given a systematic unity by his one-time pupil *Aristotle* (384-322 B.C.). But Aristotle criticized Plato's theory of Ideas as being too removed from the world of sensory objects, and as making the obvious facts of change and process unintelligible. For it was the presence of something constant in the midst of change which occupied Aristotle's serious attention, and in his *Metaphysics* as well as other writings he formulated a set of distinctions with the help of which the dynamic character of the world could be understood. The essential sobriety and encyclopedic range of Aristotle's thought won for him the description "the prince of philosophers" from succeeding generations of men, and with Plato he remains the most widely read and influential of thinkers.

With the decline of the commercial and military power of Athens, the center of philosophic thought moved from Greece to Northern Africa and Italy. A number of philosophies arose which aimed to adjust men to the demands of a changing society, to suggest satisfying ways of life without taking active part in the world's affairs, or to interpret the content of various new religions in terms of Platonic and Aristotelian doctrines. *Stoicism*, *Epicureanism*, *Skepticism*, and *Neo-Platonism* are the four outstanding schools of later Greek philosophy, and represented the outcome of assimilating the older Greek thought to new and diversified experiences. With the death of *Plotinus* (205-270 A.D.), the most famous mystic thinker of the West and in whom Neo-Platonism received its fullest development, the direct line of development from classical Greece came to an end. Rome gave birth to no original philosophy, but adapted Stoicism to the demands of an imperial civilization.

The advent and spread of Christianity produced a widespread need for supplementing the Christian account of creation and the destiny of man with a more systematic statement of the nature of things. This was achieved through many different attempts to harmonize Christian doctrine with the best pagan thought. Beginning with the various Church Fathers, and continuing through *St. Augustine* (354-430 A.D.), *Thomas Aquinas* (1225-1274 A.D.), *Duns Scotus* (1266-1308), *William of Ockham* (died 1349), down to the later Scholastics of the 17th century, Christian philosophers tried to assimilate the teachings of Plato and Aristotle to those of the Gospels, and to reconcile the revelations of faith with the discoveries of reason.

Modern philosophy is often said to begin with *René Descartes* (1596-1650), though such a dating is arbitrary and tends to obscure the continuity between ancient, medieval, and modern thought.



PHOENICIAN SAILING SHIPS

times a number of excellent harbors were maintained. These are now silted up and scarcely available for large vessels of modern construction. A number of small islands lying off the northern shore were included with ancient Phoenicia. The mountains were not particularly productive in mineral wealth, though amber and several other minerals were obtained, and the forests possessed timber of remarkable value. However, only small remnants of the once-famous cedars of Lebanon remain. An abundance of streams flow from Lebanon to the sea, providing excellent drainage and an ample supply of water power. This country, now held by the Turks and populated with a general mixture of peoples, was once the seat of a great historic people, who built the powerful cities of Tyre and Sidon, constructed highways and aqueducts, and exerted for centuries an extensive commercial and military influence in Asia, Europe, and Africa.

HISTORY. The Phoenicians have a history which extends through a period of more than 2,000 years, but it has not been definitely settled as to their original seat, nor as to the time when they formed settlements on the Mediterranean. They were Semites by race and their language shows that it, like that of the Jews, belonged to the northern Semitic group. Herodotus, the Greek historian, considers the vicinity of the Persian Gulf to have been the original seat of the Phoenicians, while other writers think they had their prehistoric origin in the region of the Dead Sea and that they emigrated to the coast because of earthquakes. They called themselves Canaanites and their land was known as Canaan, but the latter name extended also to the regions occupied by the Israelites. When the Israelites invaded Canaan, no marked change was made in the geography of Phoenicia. It had been assigned to the tribes of Asher, Dan, and Naphtali, but they conquered only a small part of it, and the relations maintained between the Israelites and the Phoenicians were mostly those of friendship. They not only maintained commercial intercourse with each other, but evidences exist that the two peoples maintained social relations to at least some extent. This is proven by a treaty made between Hiram, King of Tyre, and David, and by the

PHOENICIA

marriage of Ahab to a princess of Phoenicia.

The ancients generally thought that the Phoenicians were the inventors of navigation, though this is not at all certain. However, it is true that their ships excelled those of the Greeks in speed. They possessed vessels of excellent construction and had officers whose skill in manning, loading, and directing the vessels was unrivaled. They were pioneers in planting colonies with the view of enlarging trade. For this purpose they founded successful settlements in Cyprus, Rhodes, and the islands of the Aegean Sea. Later they passed through the Strait of Gibraltar and founded colonies on the western coast of Spain and Portugal and on the northwestern coast of Africa. Their voyagers cruised on the coasts of Hindustan and among the East Indies, which they reached from the Red Sea. In Northern Africa they founded Carthage, which was their most powerful settlement. Ultimately they brought Spain into subjection and long rivaled the imperial power of Rome. It appears that their government at the time of the exodus of the Israelites was administered exclusively by chiefs or kings, each being limited in the exercise of large powers in a particular city or town. Later Sidon became the seat of influence over all other states, but this distinction finally passed to Tyre.

Hiram was the last powerful king of Tyre. He was succeeded in 947 B.C. by his son, Balearastus, who died seven years later. The reign of Hiram was the golden age of Phoenicia, when the manufactures, commerce, and educational institutions were the most brilliant. His administration includes a period with as much splendor and prosperity as that of Solomon among the Israelites. Shalmaneser, King of Assyria, invaded Phoenicia about the middle of the 8th century, after that country had been disturbed by internal strife and invasions, but, after laying an unsuccessful siege on Tyre for five years, he concluded a peace favorable to the Phoenicians. Two centuries later Phoenicia was conquered by the Assyrians, subsequently it became a part of Babylonia under Nebuchadnezzar, and finally Cyrus the Great annexed it to the Medo-Persian Empire. During this time the cities retained a large part of their former independence. When Alexander the Great made his memorable invasion of Asia, the last vestige of independence passed away. Since 65 B.C. it has been a part of Syria.

PEOPLE. The Phoenicians were not only skillful manufacturers of woolen and cotton fabrics, but they excelled in producing metalware, jewelry, utensils, ornaments, ivory products, and earthenware. Tyre was noted as a producer of dyes from shellfishes and wood, and Sidon developed vast enterprise in the manufacture of glass. Their mines were constructed for con-

venience both in workmanship and sanitary regulations, and their architecture showed great inventive skill. Fishing, agriculture, farming, and fruit growing developed into vast enterprises. Later these arts were introduced to the colonial possessions. Some writers attribute to them the invention of arithmetic, lineal measurements, a graduated standard of weight, and writing, though others think they merely introduced these arts from the Babylonians to the nations of the Mediterranean. That their language was closely allied to Hebrew is evidenced by their proper names and by numerous tablets relating to the sacrificial ritual, for the reason that they contain many words found in the Old Testament. The alphabet consisted of 22 letters and the words were written from right to left. Their worship was a form of nature worship, or pantheism, and the sun, the moon, and the five planets then known were the objects of special adoration. Baal and Astarte were their two principal deities, the former representing the male and the latter the female. Human sacrifices were offered at an early period to their god Il, who corresponded somewhat to the Moloch of the Ammonites. Only fragments of their literature and inscriptions remain.

Phoenix (*fē'nīks*), a mythical bird of Egypt, represented as a species of plover with red and golden plumage, often depicted as having human arms. The bird has been mentioned in history in various connections and has been associated with the Sothic cycle by some writers, who supposed it to return every 500 years. Herodotus and others recount that the bird, at the age of 500 years, transformed itself into a new being by kindling a fire of aromatic gums and wood and burning up its old body, after which the new bird arose from the ashes. The phoenix was used as a symbol of immortality by the Egyptians, and it appeared upon the coins of Constantine in 334 A.D.

Phoenix, largest city and capital of Arizona, in the south central part of the state, seat of Maricopa County, 1,083 ft. above sea level. It is served by the Atchison, Topeka and Santa Fe Ry. and the Southern Pacific R.R. Sky Harbor Municipal Airport is located 3.5 m. S.E. of the city. Its corporate area of 187.4 sq. m. includes many parks. Of these, Phoenix South Mountain Park is the largest municipal park in the world (14,800 acres). Papago Park (2,000 acres) and Encanto Park (227 acres) are other recreational points. Important buildings in the city include Luhrs Tower and Trinity Cathedral (Protestant Episcopal). Camelback Mt., 14 m. N. of the city, is a famous landmark. Luke Air Force Base is within 17 m.; Williams Air Force Base, 30 m.; and Naval Air Facility, Litchfield Park, a plane storage and fly-away station, 17 m.

Because of its mild winter climate, the city

attracts great numbers of tourists. The World's Championship Rodeo, sponsored by the Junior Chamber of Commerce, is the highlight of the winter season.

Phoenix is the economic and financial center of Arizona. Its principal industries are in the electronic field; other enterprises include aluminum extrusion, air pressure equipment, evaporative coolers, and transistors. Phoenix is part of a standard metropolitan statistical area (pop., 1960, 663,510) which includes all of Maricopa County. The city had a value added by manufacture of \$142,544,000 in 1958.

The public-school system enrolls ca. 77,000 annually. Other educational institutions include Phoenix Indian School (1,000 students); Phoenix Coll.; Grand Canyon Coll.; Arizona State Coll. at Tempe (ca. 10 m. E.), and the American Inst. for Foreign Trade (ca. 13 m. N.W.). Cultural facilities include the Arizona Museum, a pioneer museum containing artifacts of territorial days; the Heard Museum, containing a large collection of prehistoric relics and Indian and Spanish exhibits; the Phoenix Little Theater; and the Sombrero Playhouse.

Phoenix was first settled in 1870, although a few pioneers had visited the site earlier. The city was built on reclaimed desert on the ruins of prehistoric Indian settlements, some traces of which are still to be found. Incorporated as a city in 1881, Phoenix became the capital of the territory in 1889 and of the state in 1912. It maintains a mayor-council form of government, whose members are elected every two years, and an appointed city manager. In 1890 the population was 2,000; in 1910, 11,134; in 1930, 48,118; and in 1940, 65,414. The decade of greatest growth was between 1950, when the population was 106,818, and 1960, when it was 439,170.

Phonetics (*fō-nē'l'iks*), the science relating to the articulate sounds of the human voice, each sound being represented by a distinct character. Voice is transformed into speech by the lips, tongue, teeth, and palate. Speech is a modification of the vibrations generated by an outward passage of air between the vocal cords of the larynx, the modification taking place as the vocalized sound passes through the cavities of the mouth and nose.

The registration and measurement of speech sounds in the scientific field of *experimental* phonetics is performed by mechanical or electrical devices, including the kymogram and the oscillograph. *Descriptive* phonetics, nearer to the humanities than to the sciences, describes and compares speech sounds in terms of the articulatory processes by which they are produced, and transcribes speech sounds in more or less arbitrary symbols. With the transcription alphabet of the International Phonetic Assn. (I.P.A.), plus various

other modifiers, the pronunciation of any variety of American English can be transcribed and reinterpreted.

Articulate sounds are divided into vowels and consonants. The English language has 26 letters, but there are many more elementary sounds, this being due to the fact that a number of the letters have more than one elementary sound. *Vowels*, or *vocals*, consist of pure tone only. They are generated in the larynx and are made with the vocal organs open. A nasal quality is acquired when the back entrance to the nostrils is closed. The vowels include *a*, *e*, *i*, *o*, *u*, and sometimes *w* and *y*. The *consonants* are formed entirely in the parts above the vocal cords, the outward current of air being modified in various ways in its course through the throat and mouth. The six classes of consonants include labials, linguals, linguo-dentals, linguo-nasals, palato-nasals, and palatals. *Labials*, or *lip sounds*, are made or modified by the lips; *linguals*, or *tongue sounds*, by the tongue; *linguo-dentals*, or *tongue-teeth sounds*, by the tongue and teeth; *linguo-nasals*, or *tongue-nose sounds*, by the tongue, the sound passing through the nose; *palato-nasals*, or *palate-nose sounds*, by the palate, the sound passing through the nose; and *palatals*, or *palate sounds*, by the palate.

American dictionaries have used two main arbitrary systems of phonetic symbols to indicate pronunciation. One system treats each word as a separate unit, pronouncing it according to formal standards. The second system associates the word with others as it occurs in colloquial speech. The New Standard Dictionary uses a table of 48 simple sounds, and Webster's New International Dictionary uses 66.

It is now possible to spell English words correctly if the speller knows the phonetic values of letters and letter-combinations used in writing. For instance, the letter *A* is used for 8 different sounds, as in "all," "artistic," "chaotic," "fat," "fare," "ale," "any," "sofa"; the letter *E* for 8, as in "get," "prey," "sergeant," "fear," "fern," "meet," "valley," and "over"; the letter *I* for 4, as in "hit," "habit," "isle," and "machine"; the letter *O* for 10, as in "obey," "go," "not," "nor," "atom," "move," "wolf," "come," "worst," "women"; and the letter *U* for 6, as in "full," "rule," "but," "burn," "feud," "injure." Thus, the five English vowels are used to indicate more than 30 separate and distinct phonetic sounds.

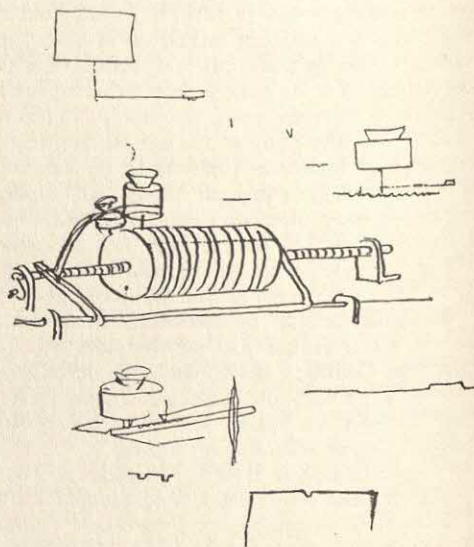
Advocates of spelling reform have pointed out the large number of English words which have silent letters that must still be spelled out and have advocated the changing of such words as "though" and "catalogue" to their new streamlined spellings, "tho" and "catalog." Despite the apparent legitimacy of their premise, spelling re-

form meets with opposition among educators.

Phonograph (*fō'nô-gräf*), an instrument capable of converting a previously recorded, undulating or sinuous groove, on a disk or cylinder, into audible sound vibrations. It was invented by Thomas A. Edison (*q.v.*) in 1877 and since that time has been vastly improved.

The phonograph depends for its operation upon the principle that sound waves may be instantaneously represented by the displacement, from its normal position, of a diaphragm, stylus, ribbon, crystal, or similar device. Since sound waves consist of alternate areas of compression and rarefaction in air, the diaphragm, stylus, or ribbon will be displaced an amount and at a rate determined by the intensity of the sound and the number of compression and rarefaction alternations occurring per second. In other words, the intensity or volume of the sound determines the total displacement, and the pitch of the sound determines the number of vibrations. The next step is to attach a stylus to the diaphragm and then, as a soft material is moved beneath the stylus, a groove will be traced in the material which will instantaneously represent the displacement of the stylus both as to intensity and pitch.

This was the principle employed by Edison in his first machine. A cylinder, coated with tinfoil,



EDISON'S FIRST SKETCH OF THE PHONOGRAPH

was used as the soft material. The stylus, fed along the cylinder by a screw, was attached to the diaphragm. Displacement of the diaphragm thus caused indentations in the constantly progressing groove in the tinfoil, the number of indentations per second and their depth being determined by the pitch and volume of the

sound striking the diaphragm. When the stylus was caused to retrace the groove in which the indentations had been recorded, a detectable sound output was observed.

Credit for the improvement of the early phonograph into a commercially accepted instrument belongs to Eldridge Johnson (1867-1945), the founder of the Victor Talking Machine Co., who developed the first spring-wound motor for talking machines, the first successful governor to insure a constant turntable speed, and who made improvements in the sound box. Many improvements in the record-playing instruments followed, and in 1925 the first all-electronic phonograph was produced. High-fidelity (high-fi) and, later, stereophonic music reproduction followed, made possible through the science of electronics (*q.v.*).

In addition to the cylinder-type record invented by Edison, a disk-type record employing a spiral groove was also developed. This gradually replaced the cylinder record, which is now used only in certain special applications.

Two general methods are used today for recording on disks. (A hard material has replaced the soft material formerly used.) One, which is the most commonly used for commercial records, is known as the "lateral" method, which employs the sidewise displacement of the groove from its normal position. The other, which was the most common in early recording, is known as the "hill-and-dale" method. This system employs a variation in the depth of the groove as a means of tracing the variations in pitch and intensity. This system is used in some transcription-type recordings. Stereophonic recording, however, employs a combination of the two methods.

In order to make the phonograph record available for general use, it was necessary that manufacturing processes be developed to permit making thousands of copies of the original recording. The general procedure for doing this was to make the original recording on a wax-coated disk. The sound was transmitted from the studio to a stylus which cut grooves in the soft surface of the disk. The wax surface then was given a coating of metallic powder to make it electrically conductive. A "negative" copy of the original "master" was made by depositing a layer of copper on the face of the master through an electroplating process. This copper duplicate was then separated from the master and called a "mold" or "mother."

After many years, the practice of placing the original recording on wax disks was discarded. Today, the sound is recorded first on magnetic tape, which provides greater flexibility in editing and finer reproduction of the music and also assures long life of the original recording. After

the tape has been edited, the sound is electrically recorded onto a lacquer disk which serves as the master.

From this master, a series of "negative" and "positive" copies are made in metal through electroforming processes, the final "stamper" being used to reproduce the finished record. From the ruggedly made metal stamper many thousands of records can be reproduced without impairment of original fidelity. Records are pressed in an automatic machine resembling a large waffle iron, two stampers pressing both sides of the record at the same time into a thermoplastic material.

Originally the wax records were made by the acoustic method. Sound waves from the orchestra or individual instrument striking the diaphragm of the recorder caused the stylus to vibrate directly from the energy contained in the sound waves. This imposed a hardship upon



STEPS IN TAPE RECORDING

As the orchestra plays in the recording studio, a tape recorder picks up the sounds; and an engineer (*above*) adjusts the controls for volume and tonal quality. From the tape the music is re-recorded (*below*), with the sound grooves cut into the surface of a lacquer disk (*courtesy Radio Corp. of America*)





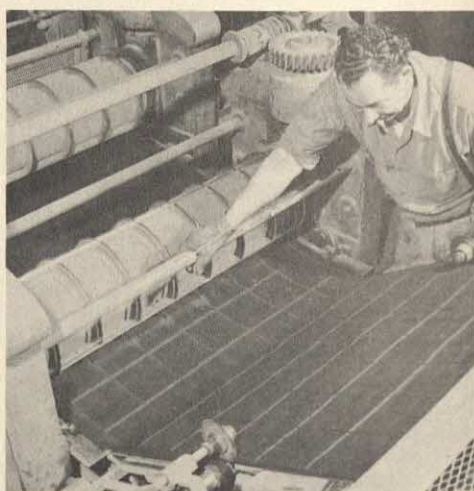
MASTER AND MOLD

The grooved disk receives separate layers of silver, nickel, and copper (*above*). The metal portion, called the "master," is then removed from the disk (*right*) and coated with nickel and copper. This layer, removed, is the "mold" from which records are pressed



CUTTING THE "BISCUITS"

The metal "master" receives careful testing (*above*) before the nickel-and-copper "mold" and the hard nickel "stamper" are made from it. Vinyl plastic, on a conveyor belt (*right*), is cut by circular knives into "biscuits," each of which makes one record



PRESSING A RECORD

The two sides of the record are pressed simultaneously; automatic machines affix labels, trim the edge, and punch a hole in the center of the record

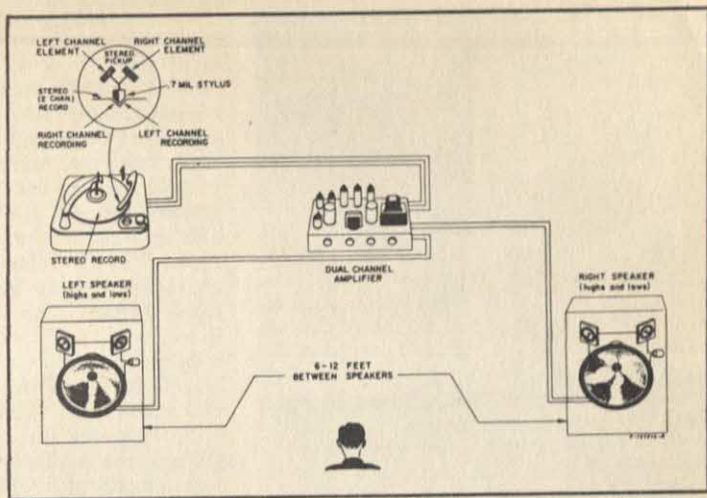


THE ART OF PACKAGING

The finished product is packaged in a colorful jacket before shipment to dealers (*Photographs in this series courtesy Radio Corporation of America*)

STEREOPHONIC SOUND

In stereophonically recorded music, the sound is recorded by two microphones spaced so that each records predominantly the sounds from the entire orchestra, although each also picks up sound from the nearest section of the orchestra at a reduced level. The output of each microphone is recorded separately and played back through separate speakers (courtesy RCA Victor Radio and "Victrola" Division)



the artists in that it was necessary to group them as closely as possible about the sound pickup horn in order to utilize practically all of the sound-wave energy. With the advent of radio broadcasting and the development of the microphone and amplifiers, it became possible to use electrical power instead of acoustic power and a marked improvement in both tone quality and volume resulted.

The most significant development in the recording science was the use of electrical recordings in place of the mechanical method of "brute-force" impressions in a wax or other type of disk or cylinder. Microphones replaced acoustic horns, and a finely controlled, electrically driven stylus took over the recording task from the crudely designed cutting needle. New record materials—smooth, tough, thermoplastic materials—delicate, lightweight pickups and distortion-free amplifiers and speaker systems blend together to produce record players with true, high-fidelity sound reproduction.

The latest development in sound recording and reproduction is stereophonic. Stereophonic sound has been described as giving the effect of sound coming from two or more directions. This principle involves recording and reproducing two signals in a single groove. While it was first patented in 1920, it was not until 1958 that the method became a commercial reality. A stereophonic system utilizes two or more independent channels, with separate microphones in recording and separate speakers in reproduction, so arranged as to produce a sense of realism of recording-hall acoustics and location of the orchestral instruments.

The record-playing instruments of today are virtually scientifically perfect, reproducing music and other recorded sounds in true realism. In fact, the sounds reproduced today are better, in many instances, than the original sound; a

singer's voice, for instance, due to electronic equipment, can be enhanced to create a fuller, richer tonal quality than the artist might actually possess.

The advantages of magnetized tape in commercial recording pointed up the broader use of this method of home entertainment. Tape players and recorders have become popular instruments for reproduction of music in the home. Tapes are prerecorded—the same as disks—and offer certain advantages over disks because of convenience in handling and storage. Blank tapes (for home recording) are available in either reel or cartridge types, as are the prerecorded versions.

See also *Juke Box*.

Phosgene (*fōz'jēn*) or CARBONYL CHLORIDE (COCl_2), a colorless, suffocating, and highly poisonous gas. Its odor resembles "musty hay or green corn." Phosgene condenses to a liquid at 8°C . Chemically, it is produced by passing a mixture of carbon monoxide and chlorine through activated charcoal or by exposing the mixture to light. It has extensive uses in organic synthesis, in the production of methyl-violet dyestuffs, as a bleaching sand for glass manufacture, and as a chlorinating agent. The word "phosgene," derived from the Greek, means "to produce by light."

Phosphate (*fōs'fāt*), a salt of phosphoric acid containing the radical (PO_4^{3-}), but phosphorus may also occur as phosphate in nonsalt-like materials such as esters of organic compounds. Phosphates occur widely distributed in nature—as phosphate rock, in organic compounds called *lecithins* as the phosphate ester of glycerol, and in plant and animal tissues. Many varieties of inorganic phosphates are known, chief of which are the orthophosphates, pyrophosphates, and metaphosphates.

Soluble orthophosphates, such as *trisodium*



Courtesy Florida State News Bureau

PHOSPHATE DEPOSIT

phosphate (Na_3PO_4), are used as cleaning agents. Other soluble phosphates are important constituents of fertilizers.

Sodium pyrophosphate ($\text{Na}_4\text{P}_2\text{O}_7$) is used as a wetting agent (to lower the surface tension of water) and as a corrosion inhibitor on iron and steel. Metaphosphates are used extensively in water softening. *Sodium hexametaphosphate* ($\text{Na}_6\text{P}_6\text{O}_{18}$) softens hard water by forming a soluble, stable complex ion by combining with calcium (Ca^{++}) and magnesium (Mg^{++}) ions.

Large deposits of calcium orthophosphates occur in Florida, Tennessee, and South Carolina, where they are mined for fertilizer. Calcium phosphate is treated with sulfuric acid to render it soluble and make its phosphorus available for plant food.

Phosphorescence (*fōs-fō-rēs'sens*), a form of luminescence (light emission independent of incandescent heat) characterized by the emission of light after the exciting agent has been removed. In a general sense the term *phosphorescence* has been used to indicate practically any of the recognized forms of luminescence: *Thermoluminescence*—production of light by heating to temperatures just below red heat; *cathodoluminescence*—production of light by impinging electrons on an object (usually some mineral); *triboluminescence*—emission of light accompanying some frictional action such as rubbing, striking, scratching, or breaking; *X-ray luminescence*—light emission resulting from X-rays striking a substance such as sodium chloride; *crystalloluminescence*—luminous display accompanying crystallization of some substances; *chemilumines-*

PHOSPHORESCENCE

cence—emission of light accompanying certain types of chemical reactions, usually oxidations; *bioluminescence*—production of light by living organisms (examples: fireflies, "glowworms," bacteria, fungi, and microscopic plants).

Phosphorescence and fluorescence are practical distinctions in the description of the emission of light as a result of the action of some exciting agent. When a solution of chlorophyll (coloring matter of green leaves) in alcohol is illuminated, the path of the light through the solution is red, while the transmitted light is the same color as the solution. When the incident light is removed, the emission of red light by the solution (fluorescence) ceases instantaneously. However, when rock salt is illuminated with X-rays, the specimen continues to give off light for several minutes after the exciting radiation has been removed. This phenomenon is called phosphorescence, and may be shown with various exciting radiations on dyes, minerals, and various substances of widely different structures. The distinction from fluorescence is arbitrary and the phenomenon is generally called phosphorescence only if the glow persists for .01 of a second or more after the exciting radiation is shut off.

In practically all known cases, the exciting radiation is of a higher frequency (greater energy value) than the emitted radiation. It is believed that the absorption of the exciting radiation temporarily raises an electron inside the atom to a higher energy level and this electron, in dropping back to a lower energy level, emits a part of the absorbed energy at a lower frequency. In phosphorescence, it is considered that the excited atom must undergo some time-consuming reaction with its surroundings in order to release the absorbed energy. Lowering the temperature of a fluorescing substance generally favors phosphorescence, and the latter is usually accompanied by photo-conductivity (conductance of the electric current as a result of illumination).

The exciting agent in phosphorescence need not be radiation. Indeed, the phenomenon of chemiluminescence is considered to consist of the direct conversion of chemical into light energy. In bioluminescence, the light emitted is never dependent on an outside agent, and is not considered to be a life process since luminous cells, when dried, become dark, but if they are dried quickly and then placed in water again, the luminescence reappears.

The phenomenon of phosphorescence has been employed in several ways. Very beautiful effects have been obtained by dyeing theatrical costumes with fluorescent dyes and illuminating the stage with ultra-violet or blue exciting light. Fluorescent lights for general illuminating purposes have been recently developed and are widely used.

These lights are composed of long glass tubes coated on the inside with a *phosphor* (usually an alkaline-earth sulfide such as barium sulfide containing a trace of some heavy metal and considerable amounts of a flux, e.g., sodium tetraborate). The phosphor is activated by the blue or ultraviolet light given off when an electrical discharge passes through mercury vapor and helium or neon vapors contained in the tube. There are many applications of phosphorescence and fluorescence in the sciences of criminology and medicine.

Phosphoric Acid (*fōs-fōr'ik ā's'id*), an acid containing the element phosphorus in its oxidized form. There are three phosphoric acids: Ortho- (H_3PO_4); Pyro- ($\text{H}_4\text{P}_2\text{O}_7$), and Meta- (HPO_3). All are derived from phosphorus pentoxide and differ in the ratio between the oxide and the water. Orthophosphoric acid is a clear, sparkling liquid, or a crystalline solid, of 1.884 specific gravity; melting point 42.35°C ; soluble in water. It is produced commercially by the Dorr strong-acid process (sulfuric acid on pulverized phosphate rock) or by hydrating phosphoric oxide and differ in the ratio between the oxide phases, in the rust-proofing of metals, in pharmacy, in soft drinks, sugar refining, water treatment, and in animal feeds.

Pyrophosphoric acid is a syrupy liquid which solidifies after long standing. Its melting point is 61°C . It is soluble in water and when diluted converts to orthophosphoric acid. It is produced by heating disodium phosphate, precipitating with soluble lead, and, in turn, precipitating with sulfuric acid. It is used as a chemical catalyst and in making organic phosphate esters.

Metaphosphoric acid (glacial phosphoric acid) is a transparent glassy solid of 2.2 specific gravity, soluble in water or alcohol. It is prepared by heating orthophosphoric acid to above 400°C ., by treating phosphoric pentoxide with cold water, or by heating diammonium phosphate. It is used as a dehydrating agent, in chemical analysis, and in dental cements and water softeners.

Phosphorus (*fōs'fō-rūs*), the name of which is derived from the Greek (*phos* = "light"; *phero* = "I bear"), chemical element No. 15; atomic symbol P; atomic weight 30.98. Phosphorus does not occur in pure forms in nature, but it is widely distributed in compounds, especially in phosphate rock, and in plants, bone, ivory, and brain and nerve tissues. It is essential to the chemical functioning of the body, from which it is excreted in the urine. Phosphorus occurs in two basic forms: (1) white (also called yellow, and when converted, black); and (2) violet (also called metallic). Between these two forms there is a partially converted form called red phosphorus.

White phosphorus (the most common form)

was one of the first elements identified. It was discovered, in 1669, by the German alchemist Brandt, who distilled it from the residue of evaporated urine in sand. Commercially, it is prepared by using an electric furnace to heat calcium phosphate (or phosphate rock), sand, and coke. The resulting vapors are condensed to a liquid, filtered, and run into molds immersed in cold water. From these come sticks of a waxy, translucent, pale-white or yellow solid; melting point 44.1°C ; boiling point, 280°C ; and density, 1.82. It is not soluble in water, but it dissolves in carbon disulfide, benzene, or turpentine. White phosphorus is not only violently poisonous, but it must be stored and handled under water because it spontaneously ignites (combines with oxygen) at about 30°C . While burning, it gives off a dense white smoke of phosphorus trioxide, P_4O_6 , and phosphorus pentoxide, P_4O_{10} . When a stick of phosphorus is half-immersed in water and kept below the kindling temperature, it combines slowly with oxygen while evolving ozone and giving off a light which can be seen in the dark. This light is called "phosphorescence," a term also applied to other "cold light" phenomena. White phosphorus is used in the production of phosphor-bronzes; in the manufacture of phosphoric acid and derivatives; in incendiaries, pyrotechnics, and smoke bombs; and in rodenticides.

White phosphorus, heated away from oxygen, converts into red phosphorus. The conversion can be speeded by the use of catalysts, e.g., iodine or selenium. Red phosphorus is used in the manufacture of matches. It does not ignite at low temperatures but must be heated to 260°C . to combine with oxygen. It is not poisonous. Black phosphorus results from heating white phosphorus under high pressure, yielding lustrous, graphitelike crystals insoluble in any solvent. Violet, or metallic phosphorus, is obtained by crystallization from solution in molten lead.

Photius (*fō'shī-ūs*), patriarch of Constantinople (858-867 and 877-886), born in Constantinople, ca. 820; died in 891. A layman who was prepared for the clergy in a short period, he was the center of a controversy between Pope Nicholas I and Emperor Michael III (who had forced his installation). Photius spoke against the pope and Church doctrines, laying the groundwork for the later Eastern Schism (see *Schism*). He was ousted from his position in 867, and replaced by Ignatius of Constantinople (q.v.), but reinstated in 877; in 886 he was banished to Armenia, where he died. A man of profound learning, he wrote "*Amphilochia*," a catechism on religious doctrine, and "*Myriobiblion*," or "*Bibliotheca*," a collection of 280 volumes of classical authors.

Photoelectric Cell (*fō-tō-ē-lēk'trīk sēl*), a device for controlling electric current by light.

In the 1870's it was found that the electrical resistance of the element selenium had the property of decreasing when light reached it. Selenium photocells were used by Alexander Graham Bell, in 1879, in the *Photophone*, an apparatus for transmitting sound over a beam of light. The selenium cell acted as the receiver of the light beam and converted the light into sound.

Two kinds of photocell are in current use: *photoemissive cells* and *photovoltaic cells*. In one type of the former, an active surface coated with cesium atoms is enclosed in the glass bulb. Light striking the active surface causes it to emit electrons, which are attracted to the anode within the cell. The sensitivity of the photocell is increased by filling the bulb with an inert gas. An external potential difference of 20 to 90 volts must be applied across the terminals of the photoemissive cell. See *Electron*.

An example of a photovoltaic cell is a disk of copper on which a layer of oxide is formed. Light shining upon the oxide produces an electromotive force at the boundary between metal and oxide, and thus no external potential difference is required. Photovoltaic cells are more sensitive to light than are photoemissive cells.

Photoelectric Effect (*ě-jěk'ě*), the emission of electrons from surfaces upon irradiation with light. Experiments by Heinrich R. Hertz (1887) and Wilhelm Hallwachs (1888) indicated the existence of this effect, and its true nature was explained by Albert Einstein in 1905. In Einstein's theory, light propagates in discrete packets called *photons* (or *quanta*) the energy of which is proportional to the frequency of the light. The energy of an electron emitted due to photon bombardment equals the photon energy less the work needed to extract the electron; if the photon energy is less than the latter, photoelectric emission does not occur. Thus, for every material, there is a certain minimum light frequency required for the photoelectric effect. While the electron energy depends upon the frequency of the light, the number of emitted electrons varies with the intensity of the light.

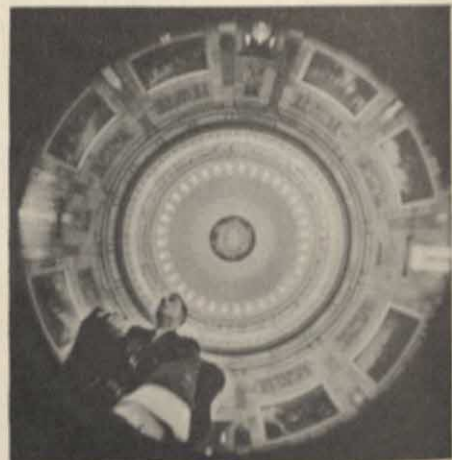
Photo-Engraving (*ěn-grāv'ing*). See *Engraving*.

Photography (*fě-těg'fě-jě*), the process of recording images by the action of light upon sensitive substances.

The first camerallike equipment, the camera obscura (*q.f.*), was known prior to 1038; Ibn Al-Haitham, or Alhazen, recorded its use in an Arabian manuscript. The effect of the camera obscura may be reconstructed by allowing light to pass through a small opening into a darkened room. An image of exterior subject matter will be projected upon the opposite wall. There was no permanent record of the image with the camera obscura, but medieval scientists used the

phenomenon in studying the eclipse of the sun, and artists applied it to experiments in perspective. Later, the use of the camera obscura was recorded in the notes of Leonardo da Vinci. Then, in 1568, Daniello Barbaro adopted the use of a lens to increase the brilliance of the image formed. The most practical portable obscura, with a lens and viewing glass, was reported by Zahn, an oculist, in 1665.

Before these early cameras were used, another phenomenon was recorded that was of the utmost importance to the development of photography. In the 8th century, Jabir Ibn Hayyam, an Arab, recorded the darkening effect of a silver compound. The reason for the effect was not definitely known until 1727, when Johann Heinrich Schultz discovered that the darkening was caused by the action of light. He recorded nonpermanent images on a silver chloride surface without the use of a camera. Continuing experimentation, Thomas Wedgwood and Humphry Davy, of England, in 1800, using a camera, formed images on paper sensitized with silver chloride. (These images were impermanent as well.)



CAPITOL DOME, WASHINGTON, D.C.

The Nikon "Fisheye" camera, covering a 180° angle of view, captures the entire dome as well as a shot of the photographer, Eric Meacham

The formation of the first permanent image—on a pewter plate, in 1826—is credited to Joseph Nicéphore Niepce. It required an eight-hour exposure. Later, Niepce entered into collaboration with a French painter, Louis Jacques Mandé Daguerre (*q.v.*), and they developed a more practical process, known as the Daguerreotype. Silvered copper plates were made light-sensitive with iodine and developed with fumes of mercury. The secret process was purchased by the French government and made public in 1839.

In the same year, however, a paper on making photographs was published by an Englishman, William Henry Fox Talbot. Unlike the French process, Talbot's process recorded negative images on paper, from which any number of positives could be made. He made ordinary paper light-sensitive by soaking it in a weak solution of common salt; it was dried, and then one surface was treated with a dilute solution of silver nitrate. The sodium chloride combined with the silver nitrate to form silver chloride, and when exposed to light it turned dark. He made contact prints of leaves and lace, as well as paper negatives, with the aid of a camera. These he fixed with hyposulphite of soda (sodium thiosulphate), which Sir John Herschel (*q.v.*) had discovered (1819) would dissolve silver chloride. An improved process followed. Instead of waiting for the action of light to bring out a visible image, Talbot developed the latent image (formed by just a short exposure) chemically. This appreciably decreased the exposure time. Talbot published, in 1844, "The Pencil of Nature," illustrated with actual photographs.



From 1933 Graflex Photo Contest

"CITY SCAVENGER," BY JACK ILLARI

This unposed picture of an old woman fishing for coins in a subway grating was caught after the photographer had watched and waited for three weeks.

The Calotype or Talbotype, as the process was called, was eventually replaced, because this paper-negative process also reproduced the texture of the paper, resulting in photographs which were not sharp.

In 1847 a method of coating glass plates with egg white and silver salts was invented by Nicéphore de Saint-Victor. Excellent detail was obtainable, but long exposures were also required. Then, in 1851, the wet-plate process was developed by Frederick Scott Archer, photographer and sculp-

tor. Glass was coated with collodion and dipped in a silver nitrate solution. The process required a darkroom wherever photographs were taken, because the plates had to be sensitized just before they were used. Although the plates were used wet and were difficult to handle, the process gave excellent results and was still in use around 1881.

With the advent of gelatin dry plates, invented in 1871 by Richard Leach Maddox, photographers had the use of ready-made plates, which could be exposed and developed in quantity at any time. The new emulsion was much faster than those of older methods. Small hand-held cameras were developed, and advanced plateholders were designed which eliminated the necessity of reloading the camera each time an exposure was recorded. Further development of camera design and of negative material was possible with the introduction of flexible emulsion bases. George Eastman (*q.v.*) introduced a paper-base strip film and, later, a transparent film. Film could now be rolled and placed inside a camera of exceptionally portable design.

The camera records light reflected from a subject. The materials essential to the recording of an image photographically are film and a camera. In its simplest form, the camera may consist of a light-tight box with a pinhole opening at one end. The film is placed in the camera at the end opposite the opening. More advanced types of camera have a lens, shutter, diaphragm, and film-advance mechanism. The *lens* is used to form an image on the focal plane. The *shutter* controls the amount of time light is allowed to pass through the lens, to be recorded on the film. The *diaphragm* controls the intensity of the light which passes through the lens. The sensitized material, or *film*, consists of a light-sensitive emulsion coated on a clear base which is usually of cellulose. The emulsion is a thin layer of gelatin in which silver halide is suspended. When light strikes the surface of the film, a latent (invisible) image is formed. To render the latent image visible, the film must be developed. The chemical process, or *development*, changes the exposed silver halide crystals to metallic silver. When development is completed, the negative is placed in a stop-bath solution which neutralizes the action of the developer. After this step, the silver particles which were not affected by light during exposure must be removed to make the image permanent. This is accomplished by placing the film in a solution called the *fixing bath*. Here the unexposed silver halides are made soluble in water, without affecting the metallic silver that forms the visible image. The film is then washed to remove all chemicals and hung up to dry. If the negative is examined at this point it can be noticed that what were once colors in the sub-

ject have become shades of gray, ranging from black, through gray, to areas that are almost clear. Further examination shows that light-colored objects are dark or dense on the negative and that dark objects are light to transparent. In other words, the image formed is the reverse of the original. The reason for this is that bright objects reflect more light than dark ones and that the light reflected from a bright object will affect more silver halides in the emulsion. The more silver halides affected by light, the darker, or denser (referring to the amount of metallic silver grains contained in the emulsion), that area on the negative will be.

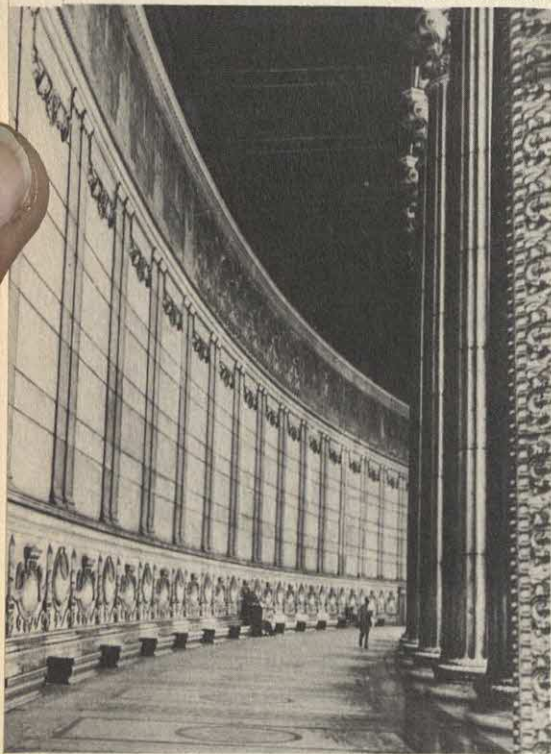
The production of the positive print is much the same as that of the negative. The negative image is either projected to (enlargement) or placed in contact with (contact print) a paper coated with a light-sensitive material similar to that of unexposed film. Following exposure, the print is developed, fixed, washed, and dried.

Many different types of printing paper, film, and developer are made commercially, each designed for a special effect or purpose. Thus,

"PERSPECTIVE," BY CPL. DANIEL KAMINSKY

This photograph won fourth place in the black-and-white group of the All-Army Photography Contest, 1953

U.S. Army Photograph



printing papers may be soft, medium, or hard, to produce a normal print from contrasting, normal, or flat negatives respectively, or they may be of different textures, such as glossy or dull. Films may be orthochromatic, panchromatic, or infrared depending on how they are to register the various kinds of light ray, from ultraviolet to infrared. Normally, photographic emulsions are sensitive to ultraviolet rays, which are invisible to the eye, but by chemical means emulsions are prepared to be more or less sensitive to certain light rays and thus are adapted to special uses. Films may also be slow, fast or super-speed, depending upon how rapidly they are affected by light rays. Developers may be hard, soft, fast, or slow to give special effects; or they may be fine-grain for use on film intended for enlargement.

As mentioned before, the simplest camera consists of a lightproof box with a pinhole at one end and a film or plate at the other. The cheap box camera with a single lens and fixed focus is the simplest form of practical camera. More expensive cameras have multiple-element lenses, accurate shutter mechanisms, focusing racks, and bellows to vary the distance between the plate and the lens in order to obtain critical focus. Such cameras may be focused by means of a ground-glass plate which occupies the plane of the plateholder; by a mechanically coupled range finder; or by a graphic scale, divided into feet or meters, which is hand set according to visual estimate or actual measurement of distance. The reflex camera employs a reflecting plate located at an angle behind the lens. This plate reflects the image onto a ground glass, where the picture is composed. View finders may be of the simple brilliant type placed near the lens or may be located on the body of the camera, or a combination view and range finder may be built into the camera. The aperture, or "gunsight," type of view finder is popular for sports and newsreel photography.

Cameras are adjusted according to the amount of light which is to be registered, according to the shutter speed necessary to take the picture, and according to the distance between the camera and the subject. These three adjustments must be made on all cameras except the fixed focus type, which is a compromise between the least and greatest distance the camera will register, *i.e.*, between about 6 ft. and infinity. Another exception is the inexpensive pinhole, or aperture, type of camera, which requires no adjustment. There are many different varieties of camera; some contain built-in exposure meters; some have attached flashlight mechanisms; some are adaptable for film, cut film, or plates. Other cameras are specially constructed for motion pictures, aerial photography,

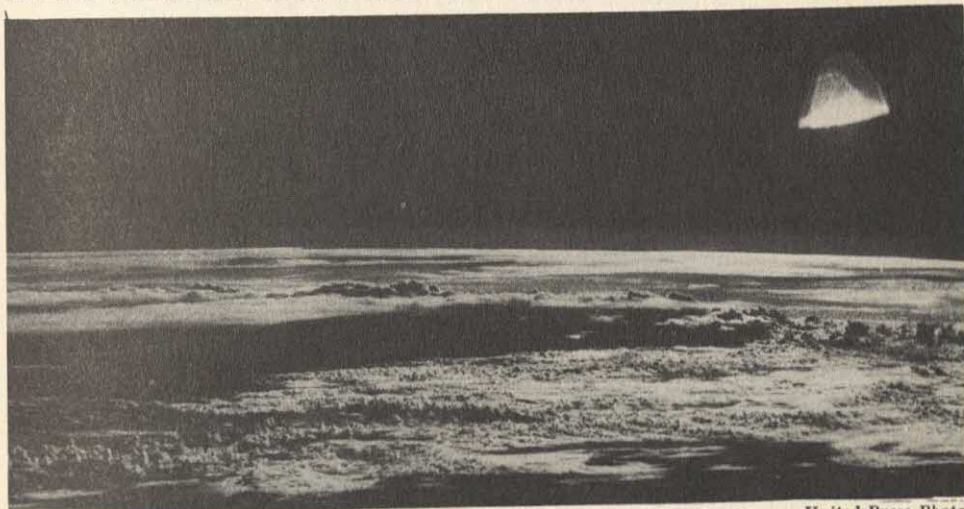
X-ray pictures, or high-speed moving objects, such as bullets in flight.

SPECIALIZED TYPES OF PHOTOGRAPHY

Aerial photography is used in surveying, map making, military observation, archaeology, and geology. Special aerial cameras have been developed for automatic operation. These have electrically operated shutters and film-advance mechanisms, special heating units for high altitude, and antivibration devices. Photographs can be taken at night using flash bombs or powerful strobe units. Infrared film is used for camouflage

separate plates make it easy to prepare three separate halftones, each of which is inked with a different color, for use in magazine printing. The development and printing of color has been simplified somewhat during the past few years, but it is not suggested that the average person attempt the process without sufficient instruction.

Microphotography (not to be confused with photomicrography, see *below*) is the reproduction of original material to a very small scale and is used wherever extensive records must be kept. Special viewers are used to enlarge the



United Press Photo

STORM CLOUDS AS PHOTOGRAPHED FROM MILES ABOVE THE EARTH

detection and to penetrate haze. Certain cameras can photograph an area about 36 sq. m. in extent from a height of *ca.* 20,000 ft.; there are cameras which can cover as much territory as 300 sq. m. from the same height. Another method, employing three wide-angle lens cameras taking overlapping pictures, can photograph up to 20,000 sq. m. within three hours' time.

Color photography is not a recent development. In 1862, Louis Ducos Du Hauron worked out the theories which form the basis of all current color processes. One of these processes uses a film sensitized by cyanide dyes in three layers. Each layer records a different color—blue, yellow-green, and red. The resulting film is called a color transparency and is suitable for projection as well as print reproduction. Another film produces a color negative, with colors complementary to the original subject. This film can be used to make color prints. Still another film contains a screen within the film and gives color negatives. Studio cameras, commonly used in commercial advertising, are equipped with colored lenses and used with three individual plates, each of which registers the light through a different lens. These

recording film when the material is to be read. A complete book of 60 pages may be photographed on a sheet of film the size of an index card. During World War II an application of microphotography was the "V-Mail" letter.

Motion pictures are possible because the eye is able to retain an image, momentarily, after the image has disappeared from view. For this reason, a series of still photographs of a moving object, rapidly projected, will appear to be a continuous moving scene.

Photomicrography is a method of making photographs of minute objects through a microscope to which a camera is attached. The term is also used to indicate the image of the photometric curve made by a beam of light passing through a microphotometer and falling on light-sensitive paper. See also *Photometry*.

The *Polaroid Land* system produces a photograph, within 1 min. after exposure, inside the camera. A feeding strip of treated paper is held in contact with the exposed negative between pressure rollers. When they are pulled together, a pod is broken and a reagent is spread between the two by the rollers. This reagent is cap-

able of developing the negative and forming a positive image on the paper at the same time.

Stereoscopic photography is a method used to reproduce a scene in three dimensions. The stereo camera takes two photographs. When they are put in a special viewer, each eye sees one of them, and an illusion of depth is created.

Photogravure (*jō-tō-grā-vūr'*), one of several arts of producing printing plates. The process is similar to photo-engraving. See *Engraving*.

Photometry (*jō-tōm'ē-trý*), the science of measuring the intensity of light, which is determined by comparing it with a standard of reference, such as the lumen or the foot-candle. The standard light is that given from one English spermaceti candle, which weighs $\frac{1}{16}$ pound, and burns 120 grains of wax per hour. Other standard light sources are: the standard Hefner lamp, which burns amyl acetate, and represents 0.9 candle; the standard Carcel lamp, which burns colza oil, and is equivalent to 9.6 candles; and the standard Harcourt pentane lamp, which burns pentane, and gives a light equivalent to 10 candles.

The **lumen** is a unit representing the amount of light emitted by a point-source of 1 candlepower. As the rays of light from this point-source go forward they spread over a larger and larger area, and thus the illumination from the point-source becomes weaker as the distance from it increases. The amount of light falling on a surface 1 cm. sq. at a distance of 1 cm. from the point-source of 1 candlepower is called a "phot," and it represents 1 lumen of light at 1 cm. The amount of light falling on a surface 1 ft. sq. at a distance of 1 ft. is called a **foot-candle** and it approximates closely 1 lumen at a distance of 1 ft. The amount of light falling on a surface 1 meter sq. at a distance of 1 meter is called a **lux**; this represents 1 lumen at a distance of 1 meter. The intensity of illumination falling on a surface varies inversely with the square of the distance between the surface and the light source. Thus, the amount of illumination equals the candlepower of the light divided by the distance (from the light source) squared. This illumination may be expressed in foot-candles or lumens.

An instrument for comparing the illumination from different light sources is called a photometer. Early photometers, such as the Bunsen photometer, consisted of a frame holding a paper on which there was an oiled spot. Light passed readily through the spot in contrast to the paper until the frame was moved between two lights so that both sides were equally illuminated. Then the spot disappeared. The distance was measured on one side of the frame to the standard light, and on the other side of the frame to the light being tested. The comparison of the two distances represented the difference in intensity between the two lights. The Joly photometer was similar, except

that wax disks were substituted for oiled paper. The Bouguer photometer consisted of a rod and a screen. The standard light was placed to cast the shadow of the rod against the screen. The light under test was moved until it cast a shadow of similar density. By comparing the distance from the screen to the standard light with the distance from the screen to the light under test, the intensity of the tested light was determined.

Modern photometers consist of "light meters" or photoelectric cells connected in circuit with galvanometers, which operate an indicator on a calibrated scale to register the number of lumens or foot-candles of light being tested. Such photoelectric meters, when used in photography, are calibrated to indicate the lens opening and shutter speed needed for correct exposure of pictures, and they are frequently called "exposure meters."

Other photometric devices are used to measure or compare light, in some cases as a means of identification of materials. The nephelometer or turbidimeter determines the quantity of matter in a liquid suspension by measuring its light transmission and comparing it with a standard solution. The colorimeter is an instrument for determining the intensity or color of solutions. The power of ultraviolet rays can be measured with the actinometer. The leucoscope is a photometer for the measurement of rays of colored light. The microphotometer and spectrophotometer measure the intensity of spectral lines of light by comparing the densities of their images.

Photon (*jō'tōn*). See *Light*.

Photosynthesis (*jō'tō-sin'thē-sis*), the process by which plants convert carbon dioxide, through the agency of sunlight and the pigment chlorophyll, into carbohydrates. Carbon dioxide is taken by the plant from the air, and in solution with water from the roots, is converted (by the absorption of sunlight and the influence of chlorophyll) into simple sugars such as glucose or fructose. By the chemical process of condensation, these sugars may form cane sugar, starch, and insulin. To produce 180 grams of glucose from carbonic acid (carbon dioxide), 673,800 calories of energy are required. The leaf surface of the plant enables it to obtain this amount of energy from sunlight, and the coloring matter in the plant (chlorophyll) enables the visible rays of sunlight to be used for this conversion, as well as the invisible ultraviolet factors of sunlight. See *Chlorophyll*.

Phototelegraphy (*jō'tō-tē-lēg'rá-jý*), or TELEPHOTOGRAPHY, the transmission of pictures by electrical signals over a wire. Such pictures are often called telephotos, or wirephotos. The apparatus for sending and receiving them consists of a scanning machine, a recording machine, and intermediate electrical signals conveyed by wire. The instrument was invented by Arthur

Korn, German physicist, in 1906, who called his machine the *telephoto*. The scanning machine bears a rotating cylinder on which the picture to be sent is mounted. A tiny beam of light is projected on the picture, and while the drum rotates, the beam moves slowly until every part of the picture has been scanned. The light reflected from the picture during the scanning is registered on a photoelectric cell, which is connected in series with a battery and the telegraph line. As the cylinder revolves, the current produced in the photoelectric cell varies in accordance with the amount of light reflected from the dark and light areas of the picture. This causes corresponding variations in the current passing through the telegraph wire. The current at the receiving end passes through a Geissler tube which changes the electrical impulses into light. This light beam is focused on photographic film mounted on a revolving cylinder. See also *Associated Press*.

Phrenology (*frê-nôl'ô-jî*), a science based on the theory that it is possible to recognize specific psychological capacities and faculties from the formation of the human skull. This theory was developed by the German anatomist and physiologist Franz Gall (*q.v.*), whose first studies in this connection were made public in 1791. Among his numerous followers, J.C. Spurzheim (1776-1832), contributed most to Gall's theory during the 19th century. Today's accurate knowledge of the anatomy of the brain have disproved most of Gall's ideas. Only one of his theories is still accurate: that the cerebral hemispheres are the seats of the higher psychical activities. Among recent authorities, Bernard Hollander (1864-1934), re-evaluated Gall's ideas and tried to retain some of them in his "The Mental Functions of the Brain" (1901).

Phrygia (*frîj'i-à*), the name applied anciently to a large country in Asia Minor, inhabited by a class of people called Phryges by the Greeks. The boundaries varied at different periods, including at one time most of the peninsula, but comprising for the greater period of its history the west central part. Their language was closely allied to that of the Greeks, and they bore a close kinship to the tribes of Thrace and Macedonia. Historians are uncertain as to the early history of Phrygia, but it is thought that the kingdom rose from an older civilization, this being evidenced by a few monuments still remaining. The Phryges engaged in stock raising, mining, and agriculture, giving marked attention to the cultivation of vines and fruits. Laodicea, Apamea, and Colossae were their principal cities, in which they built many temples and monuments, a fact verified by extensive ruins. Phrygia was overrun by the Cimmerians in 670 B.C., when King Midas of Phrygia lost his life,

and 10 years later the country was made a province of Lydia. The Persians annexed it in 549 B.C.; under Alexander the Great it became a Greek territory; and later it formed a part of the province of Asia under the Romans. The inhabitants were noted for their stubborn resistance to oppression, for advancement in civilized arts, and for the influence exercised by their religion upon the mythology of Greece.

Phthisis (*thî'sis*), in medicine, term designating any consumption or wasting away, more specifically applied to tuberculosis (*q.v.*).

Phyfe (*hîf*), DUNCAN, cabinetmaker, born near Inverness, Scotland, in 1768; died in 1854. When he was about 15, he came to Albany, N.Y., as a cabinetmaker's apprentice. In 1792 he opened his own shop in New York City, becoming renowned for his graceful treatment of cabinet pieces, particularly in mahogany. The Duncan Phyfe style is named for him.

Phylactery (*fî-lāk'tēr-i*) (Greek), or FRONT-LETS, called by modern Jews *Tephillin*, a Jewish ritual device. Comprising two small cases joined by small black strips, the phylactery is worn by male Jews during the morning prayer from their 13th year on. Within the cases, which are placed on the forehead and on the left arm opposite the heart, are parchments inscribed with passages from the Old Testament, especially Exodus and Deuteronomy. This ritual is the observance of a law, as mentioned in Exodus 13:9.

Phylloxera (*fîl-ôk-sē'ra*), a genus of lice classed with the aphidae, which feed as parasites on many kinds of plants. The most noted species is an injurious pest to the vine. This form is native to North America, where it was first observed in 1854, but it has passed to practically all countries in which the grape vine is cultivated. It infested the native grapes at the time America was discovered and with the development of grape culture it began to attack the cultivated species, but for many years the cause of grape destruction by this insect was not understood. The insect infests both the roots and the leaves of the vine. The forms infesting the roots are the wingless females, which suck the sap by means of an elongated rostrum and cause swellings of the rootlets. These wingless females multiply parthenogenetically; that is, by means of unfertilized eggs without the intervention of a male. After a few generations winged females are produced. They feed on the leaves and buds where they lay two sizes of eggs. When the vine is infested by a large number of these insects, the roots become knotted and deformed, and the leaves turn yellowish, and later life ceases.

Phylum (*fî'lûm*), the principal subdivision by which animals are classified. By common agreement the animal kingdom has been broken down into a series of subdivisions, in which the phylum

is the largest. Under this arrangement every animal is classified first by phylum, then by class, then by order, family, genus, and species. In all, there are 17 distinct phyla, Phylum Protozoa representing the simplest form of animal; Phylum Chordata the most complex.

Physical Education (*fiz'ī-kal ěd-ū-kā'shūn*), a phase of education which emphasizes total fitness through the development and care of the body, with reference to hygiene and systematic exercises. America did not begin to formulate its own philosophy of physical education until after World War I. Prior to that America had been experiencing what is called the "battle of the systems," in which intercollegiate and inter-scholastic athletics had grown rapidly, but without much educational direction. The playground and the recreation movement began to acquire momentum and such groups as the American Association for Health, Physical Education and Recreation, and the Health Co-ordinating Council were formed.

However, with the outbreak of World War II, army and navy physicians found that American youths were still far from perfect physical specimens. Many youths, particularly those living in the cities, were found to lack arm, shoulder girdle, and upper back muscle strength; many also lacked endurance. On the whole, however, it was found that most of the weaknesses were remediable, and most schools and educational institutions adopted programs of physical education, with many programs amounting to at least one hour a day of organized exercise. More instruction was devoted to health, and particularly nutrition—with the net result that the average American youth is now in better physical condition than at any other period during the 20th century.

Physical Unit (*ū'nīt*). See *Unit*.

Physick (*fiz'ik*), PHILIP SYNG, surgeon, born in Philadelphia, Pa., July 7, 1768; died there Dec. 15, 1837. In 1785 he was graduated from the Univ. of Pennsylvania, studied medicine in Philadelphia and London, and in 1791 received a license from the Royal Coll. of Surgeons in the latter city. During the yellow fever epidemic of 1793, in Philadelphia, he acquired a reputation as a successful practitioner, and the following year became surgeon of the Pennsylvania Hospital. His successful treatment of diseases and the introduction and improvement of numerous useful instruments caused him to be called the "Father of American Surgery." Among the many honors bestowed upon him were a degree by the Univ. of Edinburgh in 1792, presidency of the Phrenological Society of Philadelphia in 1822.

Physics (*fiz'iks*), the branch of science which sets as its object the ability to predict the behavior of natural phenomena with the help

of a system of laws derived from observations and experiences. Physics is a quantitative science. There are two main branches of physics: (A) experimental and (B) theoretical. (A) is the science of observation and experiment which gives accurate knowledge of the actual behavior of natural systems. (B) builds up a system of quantitative relations among measured quantities and formulates these relations with the help of mathematics into physical laws.

The subject matter of physics is usually divided into a number of branches: mechanics, acoustics or sound, heat or thermodynamics, electricity, magnetism, and optics. The reason for this type of classification is found in the historical development of the science which originated in the concepts of direct sense perceptions. The above division of physics is called the classical and customary one.

Mechanics, the oldest of all physical sciences, is defined as the study of the laws of motion of material bodies, *i.e.*, relative changes of position of such bodies with time. The basic purpose of mechanics is to classify these motions. Galileo (1564-1642) can be considered the father of physics. He devised, among other things, the first simple pendulum and a telescope similar to the modern opera glass. By religious intolerance and prejudice his scientific work was considerably hampered. This branch was pursued further by Sir Isaac Newton (1642-1727), who pioneered in mechanics as well as in optics. He discovered the law of gravitation. He formulated the three fundamental laws of motion which constitute the complete basis of the science of mechanics. He was the first to give precision to the concepts of mass and force. Using these Newtonian laws as basis, physicists of the 18th century worked in hydrodynamics, and developed the kinetic theory of gases (see *Kinetic Gas Theory*). Two outstanding physicists of this period are Bernouilli (1700-82) and Lagrange (1736-1813), the latter creating the tools for the mathematical formulation of some physical laws. The first air pump was invented by Otto von Guericke (1602-86).

At the time of Newton, work on thermodynamics (see *Heat*) had started. The first mercury thermometer was used by Kirchner in 1642, in 1724 Fahrenheit proposed his temperature scale, and in 1742 Celsius developed the Centigrade scale (see *Unit*).

Electricity received a great deal of attention during the 18th century but research was principally concerned with electrostatics (see *Electrostatic Induction*). The electroscope and frictional electric machine were developed. Benjamin Franklin (1706-90), Henry Cavendish (1731-1810), and Charles A. Coulomb (1736-1806), were the most outstanding men in this field at that time. Franklin performed the famous kite ex-

periment which led to the study of atmospheric electricity (*q.v.*) and invented the lighting rod.

Classical physics experienced its most rapid development in the 19th century. The theory of heat, the kinetic theory of gases, the wave theory of light, and the general law of the conservation of energy were developed. Joule, in 1847, with his experiments determined accurately the mechanical equivalent of heat known as the Joule constant.

In optics, the Frenchman Fresnel (1788-1827) developed a mathematical theory for the interference phenomenon (*q.v.*). Experimental evidence for the wave theory of light in contrast to the current corpuscular theory accumulated. The crucial experiment in favor of the wave theory was performed by Foucault in 1850. With his revolving mirror apparatus, he measured the velocity of light and showed that it travels more slowly in water than in air as, according to the wave theory, it should.

During this period the mathematical theories of electrostatics and magnetism were enlarged by Laplace, Poisson, and others, and fundamental discoveries were made with regard to electric currents. Volta, in 1800, described the first battery for producing an electric current (see *Current*). The heating effect of the current and the arc light were discovered and some relation between electricity and magnetism was suspected. Ampère (1775-1836) showed that a closed current is equivalent in its magnetic effect to a magnetic shell. He also discovered the action of a magnetic field on a current. Thus the foundation of electromagnetism had been laid. Faraday (1791-1867) contributed extensively to the development of electromagnetism. He devised the first electric motor. He converted magnetism into electricity. He formulated the laws of electromagnetic induction (see *Electromagnetism*). He found that electricity from a frictional machine can cause chemical reactions. This led further into the field of electrolysis, and finally the laws of electrolysis were formulated. He established a relation between magnetism and light; the results of these experiments are known as the Faraday effect. Maxwell (1831-79) was the theoretical physicist of this time in the field of electricity and magnetism. He introduced the assumption of displacement currents, and this in turn opened the way for the deduction of his famous equations of the electromagnetic field. He discovered and in part established theoretically the law of the distribution of velocities among the molecules of a gas (Maxwell's law). He is co-founder, with Clausius (1822-88), of the kinetic theory of matter.

In Germany, Hertz (*q.v.*) set out to verify experimentally the magnetic effect of Maxwell's

displacement currents and in 1887 discovered waves of undoubtedly electrical nature. Later it was shown that the speed of propagation of these waves is the same as that of light.

In 1895 Roentgen discovered the X-rays (*q.v.*), one of the most important developments in physics, which led the way from classical to modern physics. In 1896 Becquerel found rays emitted by uranium materials which in their properties were similar to the X-rays. His work was pursued by the Curies who discovered the element radium, which is the basic origin of the Becquerel rays. With this knowledge the science of radioactivity (*q.v.*) developed.

The beginning of the 20th century was marked by the study of the photoelectric effect, a term applied to a great variety of phenomena involving interaction between light and electricity (see *Photoelectric Cell*). Hertz, in 1887, conducted the experiments leading to the discovery of this effect, and this in turn led to the discovery of the electron (*q.v.*) by J.J. Thomson. Further experiments with photoelectrons by Millikan and others gave rise to theoretical developments such as the Planck constant: $h = 6.61 \times 10^{-27}$ erg sec. With it, the product $h\gamma$ called a quantum of energy corresponding to light of frequency γ was introduced; thus the origin of the quantum theory (*q.v.*) was proposed by Planck in 1900. In the same year Einstein developed his theory of relativity which rendered the view of motion through ether as a meaningless concept and stated that only motion relative to material bodies has physical significance.

Spectroscopic investigations had advanced considerably. They were used as a method of chemical analysis and very accurate measurements of the wave lengths of lines in the spectra of various substances had been accumulated (see *Spectroscopy*). With the discovery of the electron, theories of atomic structure began to assume a more definite form. It became obvious that the atom must be made up of numerically equal quantities of negative and positive charges. J.J. Thomson and, later, Rutherford advanced different theories as to the structure of the atom. Rutherford assumed that the positive charge of the atom is concentrated in a very small region less than 10^{-12} cm. in diameter at the center of a sphere. This charge, later called nucleus, was assumed to be surrounded by the electrons in some sort of configuration. Experimentally, this theory was confirmed by Geiger and Marsden in 1913. Objections to this type of atom were concerned with questions of stability. Bohr, in 1913, introduced his theory of the structure of the atom and of the origin of spectra. His theory constituted an extension of Planck's theory of quanta to Rutherford's nuclear atom. It was first applied to the hydrogen atom (see *Atom*).

Later, Bohr and others endeavored to extend the theory to atoms containing more than two electrons. The results were unsatisfactory. In 1924 Louis de Broglie made the suggestion that particles of matter, in particular electrons, might possess certain undulatory characteristics so that they might exhibit a dual nature. His speculation was developed into a precise mathematical theory by E. Schrödinger in 1926. With additions made to it by Born, Heisenberg, Dirac, and others, this theory has become the successful quantum mechanics of the present day. This quantum theory has been applied to the process of emission and absorption of radiation, to the theory of specific heat and many other physical phenomena. This theory has been used to explain the origin of spectral lines and gave some information concerning the mass and charge of the nuclei. See also *Quantum Theory*.

New lines of attack have been developed recently and knowledge of the nucleus is well advanced. Progress has resulted from work in several fields: (1) radioactivity, (2) artificial transformation of nuclei by bombardment with particles from radioactive substances or with high-speed protons or with neutrons or with other charged particles produced by laboratory methods, and (3) direct measurement of nuclear magnetic moments.

Applying an electric and a magnetic field to different substances, J.J. Thomson was able to measure the masses of atoms by observing the deflection produced on positively charged ions of the substance under the influence of these fields. He used a method similar to the one he had used for his experiments to determine the mass and charge of the electron. These positive ions in motion are frequently called positive rays. The three sources available for positive rays are: (1) canal rays used for investigating substances in gaseous or vapor form; (2) positive ions emitted by salt when heated under certain conditions; and (3) positive ions resulting from vaporization in the discharge tube of the substance under study. The last two sources are used when the substance is available only in the solid state. By a systematic study of the relative positions of the various traces on his photographic plates Thomson could determine the origin of the traces. He identified traces due to H^+ , O^+ , and others, using these as standards. The masses of atoms producing other traces could then be determined, too. Later, Aston, with his mass spectrograph with its greater sensitivity, was able to give a more precise method. With this instrument Aston verified Thomson's findings, the existence of two kinds of neon atoms which differ from each other only in having different masses. They were called isotopes of the neon atom. Isotopes have been

found for other atoms, too, differing in their weight but otherwise identical regarding all their physical and chemical properties. All 96 elements have now been analyzed by means of the mass spectrograph. A few interesting facts show up when one looks through the list of all existing isotopes. For some 17 of all the 96 elements only a single isotope is known, and all but one of these elements have odd atomic numbers. These isotopes are less numerous and less abundant in nature. On the other hand, for elements with even atomic numbers many isotopes are known; in the case of tin, for example, as many as 10 are known. From mass spectrograph experiments we have now precise data concerning masses of atoms and nuclei. We know furthermore that the masses of atoms are very nearly proportional to whole numbers. This fact raised two important questions: (1) whether the various nuclei may not be built up out of one or more constituents; (2) whether or not it may be possible to transmute one nucleus into another. The first evidence suggesting an answer to these questions came from the field of radioactivity (*q.v.*).

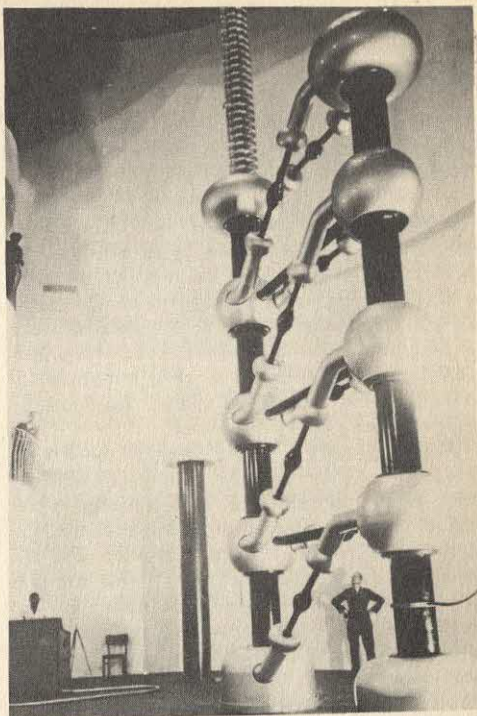
The question of the constitution of the nucleus was raised when the data on radioactivity were surveyed from the point of view of Rutherford's nuclear theory of the atom. Electrons were found to be emitted from some nuclei, and so in the beginning it was assumed that electrons formed one of the many constituents of the nuclei. On the basis of wave mechanics, it was computed that a free electron confined within as small a space as a nucleus would have to have a kinetic energy considerably larger than was observed for an electron emitted as a beta ray. Due to this discrepancy, the theory of electrons being part of the nuclei was discarded. The discovery of the neutron in 1932 by Chadwick brought a complete change of the theory of nuclear structure. The neutrons are particles of almost the same mass as a proton but have no electrical charge at all. In the theory of nuclear composition generally held today, it is assumed that (1) nuclei are composed of protons and neutrons, and (2) when an electron is emitted from a nucleus as a β ray it is created in some way at the instant of emission, a neutron in the nucleus changing at the same time into a proton. If a positron is emitted, a proton changes into a neutron. It is clear that the protons and neutrons composing a nucleus must be held together by attractive forces. The true nature of these forces and the exact law of their action are not known with certainty. One general property which the nuclear forces must possess is that the interactions between particles which hold the nucleus together are sharply limited in range. Presumably the correct nuclear theory must be wave-mechanical in nature. The exist-

ence of a deuteron consisting of one neutron and one proton shows the existence of attraction between its two components. Since a proton and a neutron interact in spite of the absence of an electric charge on the neutron it seems probable that neutrons also interact with one another. If this is true, then there might exist a similar short-range attractive interaction between protons superposed upon their electrostatic repulsion. If the neutron-neutron and proton-proton attractions are equal, then the theory that the number of protons in a nucleus should be considerably smaller than the number of neutrons should be correct.

Since disintegration of nuclei occurs spontaneously in the case of radioactive elements, it is natural to wonder whether nuclei might not also be disintegrated by bombarding them artificially with high-speed particles. Today transmutation of nuclei is a commonplace in physical laboratories. The pioneer experiments were carried out by Cockcroft and Walton (1932); they produced nuclear transmutations by means of artificially accelerated ions. Their experiments on lithium bombarded by high-speed protons showed α particles being emitted. The reaction can be written $\text{Li}^7 + \text{H}^1 \rightarrow 2\text{He}^4 + Q$, where Q represents the net amount of energy released by the reaction in the form of kinetic energy. Therefore we have not only a transmutation of the elements but also a release of energy out of the lithium atom at the expense of its ordinary measured mass.

In the course of some observations of tracks made by cosmic ray particles (see *Cosmic Rays*) in a cloud chamber, a photograph of a track was obtained which could have been caused only by a positively charged particle. These particles must have the same mass and numerical charge as the electron in order to account for their particular tracks. Anderson (1932) who conducted these experiments called these particles positrons. There are different ways of creating positrons, and therefore one should expect that their destruction should also be possible. This proved to be true; the most common process of destruction is one in which a positron unites with a free electron and both disappear, their energy passing away in the form of two protons of equal frequency.

In view of the high energies involved in natural radioactive processes, it was early realized that the study of nuclear phenomena would be greatly advanced if a supply of ions of various sorts moving at very high and adjustable velocities were available. Van de Graaff (1931) constructed a generator with which he was able to produce high-speed ions. His method had a few drawbacks and was improved upon by Lawrence and Livingstone, who constructed (1934)



International News Photo

GIGANTIC ATOM-SMASHER

Produces over three million volts of electricity

the well-known cyclotron (*q.v.*), applying a very different principle. They accelerated the ions by means of many successive impulses. A cyclotron is a fairly large, complicated, and expensive instrument.

In 1934, Fermi tried the effect of neutrons upon thorium and uranium and found β ray activity was induced in both. The observed decay curve for the activated uranium pointed toward the existence of four different radioactive substances which proved to be new elements and not isotopes of uranium. His results were confirmed and expanded by other experimenters. The number of different substances reported became so numerous and were interrelated in such a way that it was difficult to fit them into any plausible scheme. In 1939, Hahn and Stassmann began a thorough investigation, hoping to establish the chemical nature of the new radioactive substances. As a result of their experiments they felt justified in concluding that the radioactive substance was barium. As explanation they proposed the hypothesis that after capturing a neutron, a uranium nucleus may break up into two or more large fragments, each of the size of a moderately heavy atom. Once the possibility of this type of disintegration, called fission of the nuclei by L. Meitner, was accepted, the so-far-obtained facts fell into order

and new corroborations were obtained. Many of the fission products were recognized as substances already familiar in the study of induced radioactivity. Thorium was also found to undergo fission when bombarded with neutrons. The energy released in a fission process is enormous. Some of this energy at first would be stored in the fission nuclei as energy of excitation to be released later in β -ray activity, but much of it should appear at once as kinetic energy of the fission nuclei which should be projected apart at high speed. Variation of the speed of the incident neutrons was found to cause a marked variation in the number of fissions produced in uranium. See also *Nucleus; Unit*.

Physiognomy (*fiz-i-og'nô-mî*), the art of reading character and the quality of mind by the features of the face. It is founded upon the belief that there is an intimate connection between facial features and expression and the qualities and acts of the mind. This art was supported in the philosophy of Aristotle, who ascribed cunning, daring, bravery, ingenuity, and other traits quite largely according to the features observable in the human face. In 1586 the first authentic work on this subject was published in France by Giambattista della Porta, entitled "Human Physiognomy," in which the theories were elaborated and applied to representative cases. Sir Charles Bell published his "Essay on the Anatomy of Expression" in 1806, and may be said to be the first who gave scientific study to facial expression as related to the changes of the countenance and the muscles which produce them. Many representative writers who gave thought to psychical subjects in the last century, including Spencer and Darwin, correlated physical action with psychical states. Pieter Camper (1722-89), the eminent anatomist of Holland, wrote "Discourse on the Face" and Johann Gasper Spurzheim published "Physiognomy in Connection with Phrenology." In the 20th century, physiognomy again came to be considered a science, largely due to the works of Alfred Kretschmer, Ludwig Klages, and Max Pulver. These scholars take into account not only the face but the build of the body, the rhythm of individual movements and correlations of handwriting to certain physical and mental qualities.

Physiography (*fiz-i-og'râ-fî*), the science which treats of the physical features of the earth's exterior, including the physical movements or changes on the earth's surface. The scope included in this science embraces climate, life, and temperature, and considers the currents of the ocean and the atmosphere. In a wider sense it may be said to cover the whole subject of physical science, since it considers the important phases of botany and zoology and includes the elements of astronomy, chemistry, geology,

physical geography, and physics. The term is used interchangeably with physical geography in some instances, since it investigates and explains the origin of existing physical features.

Physiography classifies the natural divisions of land and assigns causes for their general outline and differences in elevation above the sea. The forms of the lands are undergoing changes constantly, since the bottoms of the oceans are being depressed and filled, the continents are eroded, and changes are taking place in the plains, plateaus, and mountains. In many places the rocks that lie above the sea are disintegrating and being removed through the action of winds, rains, and streams. Glaciers and oceanic waves and currents cause important changes of contour, while islands and other forms of land are acted upon by the action of rivers, which cut away banks and cliffs in some localities and build land masses in others. Both plant and animal life are influenced materially by climate and soil. These phenomena are investigated both as to source and result. The distribution of life upon earth, the agencies that tend to promote growth, and the barriers that obstruct development are all considered in their phases and relations.

The barriers that interfere with the spread of life include the ocean, mountains, deserts, and regions of extreme cold. It is apparent that the polar zones are unsuited for the propagation of life, while barren deserts are likewise a limiting influence, though the presence of valuable minerals in some cases favor habitation. Rugged mountains that reach above the snow line, such as the Alps of Europe, interfere with the spread of life, but furnish a refuge from invasion and in some localities contain mineral wealth sufficient to attract a population that otherwise could earn no living. On the other hand, localities of favorable climate and great fertility induce density of population, such as the favored districts of Western Europe, the valley of the Nile, and the islands of Japan, though such regions are in many cases favored by being located where commerce and manufacturing enterprises can be centered with more than ordinary convenience. Elevation or latitude will give climates conducive to greater effort, hence we find the greatest development of civilization of the more powerful races and nations largely confined to the temperate regions.

The configuration of the sea bottom and the depth of the ocean, their causes and influence upon animal and vegetable life, are subjects investigated by this branch of study. Though formerly the great centers of trade were located almost entirely upon navigable waters, chiefly inlets from the ocean, the construction of highways, canals, and railways, all resulting from the development of civilization, have tended to

spread the habitations of man to the most remote parts of the interior of continents. Man has so modified the configuration of the earth (canals) and so developed other means of transportation and changed climates and the importance of climate (by importing food and supplies) that the earth's surface features are no longer the dictating factors they once were. See also *Contour Map; Ecology; Geographical Distribution; Topography.*

Physiology (*fiz-i-ôl'ô-jy*), the science which treats of the functions and properties of living matter. It is divided into human, animal, and vegetable physiology. Allied subjects are anatomy, chemistry, histology, and hygiene, since physiology is dependent in large measure on progress made in these related branches. *Anatomy* treats of the number, structure, and relations of the parts which constitute an individual being; *histology* considers the minute structure of tissues as revealed by the microscope; *hygiene*, the science of wholesome living, is the study of the conditions most favorable for the healthful action of the several parts and of the whole individual; and *chemistry* is the study of the nature and properties of all matter in the universe.

LIFE AND GROWTH. *Human physiology* treats of the functions and processes that take place in the organs and tissues of man. The integral, structural unit of every living body is the cell, which is the smallest known mass of living matter. When isolated, cells assume a globular or spherical shape; but, when crowded together in tissues, they may be compressed into fusiform, cuboidal, columnar, or polyhedral shapes. A cell consists primarily of protoplasm, the substance of which all living animal organisms are composed, enclosed within a containing envelope, the cell membrane. In the protoplasm floats a darker structure, the nucleus, consisting of colored, threadlike bodies, the chromosomes (*q.v.*) in each of which are a number of paired bodies, the genes (*q.v.*), the bearers of all hereditary qualities between the generations.

Protoplasm, a soft, colorless, transparent material, is composed of water, carbohydrates, fats, and proteins, and minerals. The nucleus and its component elements preside over the reproduction of cells; but protoplasm itself possesses the power to absorb by osmosis, to grow, to move, to excrete, to secrete, and to multiply. It is most easily studied in the simplest form of animal life, the amoeba, a unicellular protozoan, possessing the properties of amoeboid movement and phagocytosis (the ingestion of foreign matter and food by surrounding it). These animal forms constitute the lowest beings, while mankind is the highest form. The individual human being develops from a single female cell, the ovum, fertilized by a single male cell

or sperm. From this fertilized ovum develop all the systems and tissues of the human body.

CELLS AND TISSUES. Every living cell is capable of receiving, as food, material different from itself; but this material must be in a state of fine division and must undergo chemical and physical changes and must thus acquire powers and properties which it did not before possess as food, until it becomes a part of the cell itself. On a small scale, this growth is similar to the growth of tissues, of organs, and of the body itself. If a cell receives food material in excess of its needs, or if it has grown to maturity, then new cells begin to form by reproductions from the old. These new cells have the same tendencies and properties possessed by the parent cells, and the rate of growth is determined by the rapidity with which new cell formations are added.

In the living body, as in the living cell, there is continuous movement and change of material. Old or used substances are removed without intermission, though this process is not rapid. New materials are constantly taken in, modified in the organism, and finally enter into its structure. When changes in cells or tissues discontinue, local death ensues; and when changes cease in the entire organism, total death results. Each individual being possesses in its organism a controlling force, the vital force, which is transmitted from generation to generation but is modified by external and internal conditions. In all the higher types of animals there are six principal kinds of tissue: blood, connective tissue, bone, epithelium, muscle, and nerve tissue.

ORGANS AND FUNCTIONS. The physiology of the various organs of the human body is discussed, in different articles, with the anatomy of each organ. In this article it is necessary only to call attention in a general way to the more specific connections between them. The skeleton consists of the bones, serves to contain and to protect the organs of the body, and constitutes an axis for its motion and support. There are 200 separate bones, joined together by 300 articulations, some of which are fixed, but the majority are movable. The ligaments which secure these joints are flexible but inelastic, and resemble tough fibrous thongs. The bones act as levers operated by the muscles to produce the variety of movements of which the body is capable. The skeleton is clothed by the muscular system, consisting of 400 masses of various sizes, shapes, and attachments. Motions are produced by the appropriate contraction and relaxation of muscles acting upon bones. Skeletal muscles are under control of the will, but visceral muscles of the heart, blood vessels, and hollow organs are involuntary. The external surface of the muscles is covered by the integumentary system,

consisting of a layer of fat, which serves as a protection against the cold and as a storage reserve of nutrition, and the skin which, with its blood vessels and appendages, also protects the body against deleterious external agencies.

The living matter of animal bodies consists essentially of the five following substances: water, mineral salts, carbohydrates, fats, and proteins. The three most important elements constituting these substances are carbon, nitrogen, and oxygen. The weight of the adult body is about 70% water and 30% solids, or 40% muscles, 15% bone, and the remainder of other constituents. Blood permeates every part of the body and directly or indirectly nourishes all the tissues and removes from them all waste products. The blood is propelled throughout the body by the circulatory system, which acts as the distributing and transportation system of the body. The blood is a liquid stream, ceaselessly propelled through a closed hydraulic system of blood vessels and valves by a central pump, the heart. From the heart, the oxygenated blood is distributed through the systemic arteries to the capillaries, in which takes place the exchange of nutritive and waste material. From the capillaries, the deoxygenated blood is gathered into the veins, returned to the heart, and thence conveyed to the lungs. In the lungs occurs the respiratory exchange, whereby carbon dioxide is eliminated, oxygen is absorbed, and the reoxygenated blood is returned again to the heart to resume its circulation. The oxygen intake and carbon dioxide output are provided by the respiratory system. The lungs are alternately inflated by inhalation and deflated by exhalation. With every circulatory circuit the blood also visits the kidneys, where urea and many other waste products are filtered out by a secretory process which produces the urine. The alimentary or nutritive system is a muscular tube, consisting of the esophagus, stomach, small and large intestines, running through the body and lined with mucous membrane. As the food passes through this tube, it is subjected to a series of chemical fermentative processes known as digestion. The digestive fluids are the saliva, the gastric juice, the bile, and the pancreatic juice.

The nervous system, the control unit of the body, regarded by psychologists as a response mechanism, is an apparatus consisting of the brain as the center of consciousness, the spinal cord, and the nerves. This mechanism serves not only to receive sensations but to initiate and direct voluntary and involuntary movements. The central organs of taste, smell, vision, and hearing are parts of the nervous system. The autonomic system is that portion which presides over the secretory, vaso-motor (blood vessel control), and visceromotor (digestive and excretory) functions.

FOOD AND NUTRITION. The animal body must be constantly supplied with nutrition, though its fat reserve makes possible a considerable period of deprivation by starvation before death ensues. Different kinds of food must be supplied to provide for the various needs of the body. The principal constituents of a normally balanced diet for human beings are carbohydrates, fats, proteins, roughage, salts, vitamins, and water. As it passes through the alimentary system, the food traverses a series of organs which act as processing chambers: the mouth, pharynx, esophagus, stomach, small intestine, and colon or large intestine. The food is chewed and mixed with saliva in the mouth, whence it passes through the pharynx and esophagus into the stomach. Here it is acted upon by the gastric juice, most acid of the body secretions, and thence passed through the pylorus into the duodenum, where it is mixed with the bile and pancreatic juice. As it passes on through the small intestine, about 19 ft. in length, the combustible substances which have been produced by the chemical processes of the digestive juices, are absorbed into the blood vessels and lymphatics, by which they are carried to the liver, which acts as a storage and distribution station. The onward movement of contents through the alimentary tube depends upon its peristalsis, a propulsive wavelike contraction which travels rhythmically the entire length of the canal. Nutritive materials absorbed into the blood vessels pass through the portal vein to the liver, and thence by the hepatic vein into the systematic circulation. Nutritive materials absorbed into the lymphatics pass upward through the thorax by the thoracic duct, and thence into the circulation. The entire process of digestion requires from 2 to 12 hours, depending on the kinds of food taken into the body. The incombustible residue of the food, after partial putrefaction, is finally eliminated from the body through the rectum and anus.

Phytopathology (*fī-tō-pā-thōl'ō-jŷ*). See *Botany*.

Pi (*pī*), a Greek letter (π), 16th in the Greek alphabet. It is used as a symbol in mathematics to represent an irrational number, 3.14159265... for all practical purposes, 3.14 (see *Circle; Number*). In physics, the character is used to designate a certain type of meson (*q.v.*).

Piacenza (*pī-ä-chēn'tsä*), a city in Italy, capital of the province of the same name (area, 998 sq. m.; pop., 1955, 298,966), on the Po River, 43 m. s.e. of Milan. Piacenza's history dates back to 219 B.C., but it is still a manufacturing and trading center. There are many famed structures, including the early 16th-century Church of San Sisto, original site of the "Sistine Madonna" by Raphael (*q.v.*), and the 13th-century Palazzo Comunale (city hall). Piacenza joined the Lom-



Courtesy Metropolitan Museum of Art, N. Y.

EARLY 19th CENTURY PIANO

bard League in the 12th century and later changed hands frequently; in 1860 it joined the kingdom of Italy. Population, 1955, 72,769.

Piano (*pī-ān'ō*), or **PIANOFORTE** (from the Italian words *piano*, meaning "soft," and *forte*, meaning "loud"), a stringed musical instrument, from which sounds are produced by blows from *hammers*. The hammers are covered by felt and moved by a system of levers attached to a series of *keys* comprising the *keyboard*. The instrument is probably the most extensively used musical device in the world. The first pianoforte, produced about 1707, was in many respects inferior to its predecessors, the *clavichord* and the *harpsichord*, instruments for which some of the music played on the pianoforte today was written. The modern pianoforte, however, as its name suggests, possesses a tonal and dynamic range far surpassing the effects possible in instruments which employed devices such as tangents, plectra, or quills set to the strings in vibration.

The modern instrument must necessarily have a heavy frame, since a large number of strings are to be stretched, and these cannot be kept in tune unless the frame is strong enough to stand a tension of approximately 20,000 pounds. Most frames or plates are made of cast iron, though some makers have recently been experimenting with aluminum frames. Strings were made originally of steel wire for the upper tones, and of brass wire for the lower tones, but modern instruments have strings wholly of steel wire. The strings pass over bridges attached to a board, and the tones depend upon their size and length. Long and large wires supply low tones, while the

short and fine wires are used for the higher tones. Wires for the lower tones are usually made of steel with a double wrapping of fine copper or steel wire. Three common forms of pianos are in general use: the *grand piano*, the *upright piano* and the *spinet* or *console piano*. The strings in the grand are horizontal, and in the upright and console they are vertical. In practically all pianos the strings run diagonally so as to take advantage of the greatest length, thereby making it possible to produce a maximum volume of tone. Most modern pianos are of $7\frac{1}{8}$ octaves, comprising 88 notes. As a rule, the large grands are used in concerts since they supply great volume and furnish practically every gradation of sound. Small grands, uprights, and console pianos are used largely in homes, schools, and studios. The styling of the console type of piano has made it particularly popular for use in small, compact living rooms. The player piano (*q.v.*), which operates automatically, is treated in a separate article.

Piastre (*pī-ās'tēr*), or **PIASTER**, a coin used in a number of countries in Europe and Asia. The piastre is used in Spain, Italy, Turkey and Egypt with various values. In a number of South American states the name is applied to money, but the value differs somewhat. See also *Coins*; *Peso*.

Piatt (*pī'āt*), **JOHN JAMES**, poet, born in Milton, Ind., Mar. 1, 1835; died Feb. 16, 1917. He began his career in a printing office and subsequently studied at Kenyon Coll. and Capital Univ. He did newspaper work in Louisville and Cincinnati, was chosen librarian of the House of Representatives in 1871, and was U.S. consul at Cork and Dublin, Ireland, from 1892 to 1893. His

first verses were written in conjunction with W.D. Howells in a volume entitled "Poems of Two Friends." Among his volumes of poetry are "Western Windows," "Poems in Sunlight and Firelight," "Idyls and Lyrics of the Ohio Valley," "At the Holy Well," and "Landmarks and Other Poems." His wife, *Sarah Morgan Piatt*, born in Lexington, Ky., Aug. 11, 1836, also wrote a number of poems. The volume entitled "Nests at Washington" was written in connection with her husband and in 1894 she published "Collected Poems."

Piave (*pē-ā'vā*), an Italian river rising in the Carnic Alps and flowing 137 m. to the Adriatic, 22 m. N.E. of Venice. After the Italian defeat at Caporetto (*q.v.*), Italian and British forces held the western bank of the Piave throughout 1917. The Austrians opened an unsuccessful offensive in June 1918. Shortly before the signing of the Armistice, the Italians, aided by British and American troops, attacked and broke through Austrian defenses on the eastern bank on Oct. 23, 1918.

Pibroch (*pē'brōk*), a form of music played on the bagpipe, which includes marches and dirges. The martial character of this music has a powerful effect in arousing the military spirit, especially among some of the people of Asia, but the rhythm is irregular and difficult to learn, since the scale of the bagpipe contains sounds unrepresented by any notation.

Picasso (*pī-kās'ō*), **PABLO**, sculptor and painter,



Collection Museum of Modern Art, N. Y.

WOMAN IN WHITE

Painting by Pablo Picasso

born at Malaga, Spain, in 1881. After study in Pontevedra, Coruña, and Barcelona, he settled in Paris (1903). A post-impressionist, he founded the modern school known as the Cubists (1908), and also invented the artistic device of collage or paper-pasting (1912). From 1915 to 1922 he abandoned cubism to some extent for a neo-classic style, and then entered on a period of surrealism. Influential in 20th century art, his thesis is that art should register the inner man, rather than physical characteristics.

His works include the oil paintings, "Green Still Life," "Harlequin," "Metamorphosis (Bather)," and "Bull Fight." He has composed many settings for Diaghileff's Ballet Russe, and numerous pieces of cubist sculpture.

Picayune (*pīc-ā-ūn'*), a word derived from the language of the Caribs and applied to a small Spanish coin which was current in the U.S. until the Civil War. The value was 6¼ cents and it was called *sixpence* in the Northern states. The word picayunish, meaning small and paltry, was derived from it.

Piccard (*pē-kār'*), **AUGUSTE**, physicist, born in Basel, Switzerland, Jan. 28, 1884; died in Lausanne, March 25, 1962. He was educated at the Swiss Inst. of Technology in Zurich. In 1917 he became professor of experimental physics at the Federal Coll. in Zurich and in 1922 professor of physics at the Polytechnic Inst. in Brussels, Belgium. In order to investigate the upper atmosphere, he invented a balloon-gondola and, with an assistant, made an ascension from Augsburg, Germany (1931). The balloon rose to 51,793 ft., the first flight into the stratosphere. The next year he made another ascension to check his findings and study cosmic rays in the stratosphere. In the 12-hr. flight, he and Max Cosyns rose to 54,134 ft. In the late 1930's Piccard turned his attention to underwater exploration, and in 1948 he and his son perfected the bathyscaphe, in which they descended to more than 13,000 ft. In recent years he did deep-sea studies for the U.S. Navy. See also *Diving*.

His twin, **JEAN FELIX PICCARD** (died Jan. 28, 1963), chemical and aeronautical engineer, emigrated to the U.S. in 1916 and was naturalized in 1931. In 1934 he and his wife made a balloon ascension from Dearborn, Mich., reaching 57,979 ft. In 1937 he became professor of aeronautical engineering at the Univ. of Minnesota.

Piccolo (*pīk'ō-lō*), a small musical instrument similar to a flute, but pitched an octave higher than the ordinary flute. Some organs have a stop called *piccolo*, the sound of which resembles the tone of a piccolo.

Piccolomini (*pēk-kō-lō'mē-nē*), **OCTAVIO**, Duke of Amalfi, born at Siena, Italy, in 1599; died in Vienna, Austria, Aug. 10, 1656. He was descended from a distinguished family, which is

noted because of supplying one of the popes, Pius II, several cardinals, and a number of writers and warriors. He entered the military service of Spain, but later was sent to aid Ferdinand II of Germany in suppressing the Bohemians, in 1621, and bore an important part in the Battle of Weisseberg. In 1632 he was at the Battle of Lützen, and historians generally state that his regiment fired the shot which killed Gustavus Adolphus. Subsequently he operated with Wallenstein in Bohemia and aspired to the Bohemian throne, for which reason he was instrumental in causing the fall of that distinguished general. In 1635 he had charge of the Spanish forces in The Netherlands, commanded in Sweden in 1648, and in 1649 became a field marshal under Emperor Ferdinand II. He was later honored by the King of Spain, who conferred upon him the Order of the Golden Fleece. Piccolomini was an eminent commander of the period in which the great contest for religious supremacy was waged in Europe, and was one of the most pronounced of the Catholic advocates.

Pickens (pik'ēnz), ANDREW, soldier, born at Paxton, Pa., Sept. 13, 1739; died Aug. 17, 1817. He moved to South Carolina in 1752, where he fought against the Creeks and Cherokees. At the beginning of the Revolution he entered the service as a captain. In 1779 he defeated a force of Tories at Kettle Creek, commanded at the Battle of the Cowpens, and received a sword from Congress in recognition of valiant service. After the war he became a member of the legislature, was elected to Congress in 1792, and retired from public life in 1812. During his political life he concluded many treaties with the Indians.

Pickens, FRANCIS WILKINSON, statesman, born at Togadoo, S.C., Apr. 7, 1805; died Jan. 25, 1869. He studied at South Carolina Coll. and took up the practice of law. In 1832 he was elected to the state legislature, where he advocated nullification and states' rights. He served as a Democratic member of Congress from 1834 until 1844. In 1857 he was made minister to Russia, but returned to the U.S. in 1860, and was later elected governor of South Carolina.

Pickerel (pik'ēr-ēl), a kind of pike, in some localities called *wall-eyed pike*. Pickerels are good food fish and reach a length of 2 ft. See *Pike*.

Pickering (pik'ēr-ing), EDWARD CHARLES, astronomer, born in Boston, Mass., July 19, 1846; died Feb. 3, 1919. He was graduated from Harvard in 1865 and the next year became instructor in physics at the Mass. Inst. of Technology. The U.S. government sent him to Iowa in 1869 to witness an eclipse of the sun. His observations were published in the U.S. *Nautical Almanac*. The following year he made a similar mission to Spain. In 1876 he became professor of astronomy at Harvard, and while engaged at that institu-

tion aided in founding an auxiliary observatory at Arequipa, Peru. He was given many distinctions because of his astronomical discoveries, including an election as associate to the Royal Astronomical Society (London) and membership in the National Acad. of Sciences (Washington, D.C.). He published "Elements of Physical Manipulation," and edited William von Bezold's "Theory of Color in Its Relation to Art and Industry."

Pickett (pik'ēt), GEORGE EDWARD, soldier, born in Richmond, Va., Jan. 25, 1825; died in Norfolk, Va., July 30, 1875. He completed the course of study at the West Point Military Acad. by graduation in 1846, entered the army as brevet second lieutenant, and took part during the Mexican War at Vera Cruz, Contreras, and Chapultepec, receiving a captaincy for gallantry at the last-named battle. In 1861 he resigned his commission and entered the Confederate army as a colonel. He served with distinction at the Rappahannock River, was severely wounded at Gaines' Mill in 1862, and on his recovery was promoted to major general. At Gettysburg (1863), he led Pickett's Charge, an offensive that was the last major Confederate effort of the battle. In 1864 he prevented the capture of Petersburg by Gen. B. F. Butler. In 1865 he commanded at Five Forks and, after being routed, surrendered with Gen. Robert E. Lee.

Pickford (pik'fērd), MARY, actress, born in Toronto, Ontario, Apr. 8, 1893. She began to appear on the stage at the age of five years under the direction of her mother, who was an actress. Her greatest successes were in motion pictures and she became known throughout America. She starred in "Rebecca of Sunnybrook Farm," "A Girl of Yesterday," "Poor Little Rich Girl," "Little Lord Fauntleroy," etc. After her retirement from acting she headed the Mary Pickford Co., a producing unit, and acquired a part ownership of United Artists. She married Charles (Buddy) Rogers in 1937 after a previous marriage to Douglas Fairbanks (1920-35).

Pickles (pik'k'ls), the general name of many kinds of preserved articles of food. The term is applied in particular to different kinds of fruits or vegetables preserved in vinegar, but in a wider sense includes animal substances preserved in salt or brine, such as fish, beef, pork, and mutton. Pickles made of vegetables are eaten as a condiment. They are steeped or parboiled in brine and then transferred to the vinegar, to which salt, mustard, horse radish, and various spices may be added.

Picric Acid (pik'rik), an organic dye obtained by treating phenol with strong nitric acid, or by dissolving carbolic acid in sulphuric acid and then adding nitric acid. It is soluble in ether, alcohol, benzol, and sulphuric and nitric acids. The taste

is very bitter. Formerly it was used extensively in dyeing silk and wool and its use for this purpose is still considerable, but at present it is employed largely in the manufacture of gunpowder and other explosives. In some countries it is used in the manufacture of beer and for many purposes in medicine, especially as a remedy for burns.

Picts (*pikts*), the race of people who inhabited the northern part of England and the eastern part of Scotland at the time of the Roman occupation. They appear to have come in conflict with the Romans about 296 A.D. and were associated by Roman writers with the Caledonians. Little is known of the language of the Picts, though they are generally regarded as of Celtic descent. In 850 the Scots, whose original seat was in Ireland, subdued the Picts and became the predominating influence in Scotland. Remains of architectural structures erected by the Picts have been found in many places in the northern part of Great Britain.

Pidgin (*pid'jin*), CHARLES FELTON, author and inventor, born in Roxbury, Mass., Nov. 11, 1844; died June 4, 1923. He opened a mercantile business in Boston in 1863, but left it 10 years later to become chief clerk of the Massachusetts Bureau of Statistics of Labor. Pidgin is known for his inventions, which include an addition register, an automatic multiple tabulating machine, an electrical adding and multiplying machine, and a self-counting tally sheet. Besides contributing to periodical literature, he published about 60 songs and wrote a number of musical comedies and cantatas. He also wrote several books which include "Blennerhasset, or the Decree of Fate," "Quincy Adams Sawyer and Mason's Corner Folks," and "Practical Statistics."

Pidgin English (*pi'jin ing'glish*), a lingua franca (*q.v.*), also called CHINESE PIDGIN, developed by the Chinese in transacting business affairs with English-speaking people. The name pidgin probably has its origin in the Chinese pronunciation of the word "business." Certain variations are known as "Beachcomber," "Bêche le Mar," and "Sandalwood English." Pidgin English also contains some word derivatives from other Oriental and Occidental languages and is used as a means of communication by millions of people in the Orient, the South Seas, sections of Africa, Australia, India, Egypt, and the U.S. A useful vocabulary requires no more than 300 words, but Pidgin English occasionally employs a larger number of words than idiomatic English would require. The words are strung together in logical sequence, with no reference to grammar. Any form of "talking" may be indicated by the word "talkee," and any concept of receiving or possessing may be suggested by "catchee," as in "my catchee too much chowchow" (I've had a lot of food).

Piedmont (*pēd'mōnt*) or PIEMONTE, a com-

partimento (region) in northwestern Italy, bounded on the N. by Switzerland, on the E. by Lombardy, on the S. by Liguria, and on the W. by France. It includes the provinces of Alessandria, Aosta, Asti, Cuneo, Novara, Torino, and Vercelli. Piedmont (area, 9,803 sq. m.) is located at the foot of the Alps, as its name indicates (*pied* = "foot"; *mont* = "mountain"). A healthful climate, fertile soil, water power, and mineral deposits make it one of the most productive regions of Italy. Turin (*q.v.*) is the principal city. Population, 1951, 3,518,177.

Piedmont Region (*pēd'mōnt rē'jūn*) or PIEDMONT PLATEAU, the foothill region of the U.S. which lies between the Atlantic coastal plain and the Appalachian Mts. Narrow and not clearly defined in the New England states, it broadens to the south, forming a plain ca. 150 m. wide in North Carolina. The surface is more elevated and rugged than that of the coastal plain. Geologically, the plateau is an older formation than the coastal plain, and its rock strata are harder. Marking the division between them is the fall line, where the elevation drops abruptly. Below this, rivers lose their currents and merge into their estuaries in the coastal plain. The region covers ca. 80,000 sq. m.

Pied Piper (*pīd pī'pēr*), German legendary character, central figure of Robert Browning's poem "The Pied Piper of Hamelin." According to folk tales, the Pied Piper succeeded in ridding the town of Hamelin of a plague of rats by luring them into the river with his music. When the town officials refused to pay him, he led the children of the town into a mountain cave, from which they never returned.

Pierce (*pērs*), FRANKLIN, 14th President of the U.S., born in Hillsboro, N.H., Nov. 23, 1804; died in Concord, N.H., Oct. 8, 1869. His father, Benjamin Pierce (1757-1839), had served in the Revolution. Franklin Pierce studied at Bowdoin Coll., where he was a classmate of the novelist Nathaniel Hawthorne (*q.v.*). Pierce sat in the state legislature while his father was governor. A member of Congress (1833-37), he was a diligent Jackson Democrat, orthodox except for approving internal improvements at Federal expense. Pierce resigned from the Senate in 1842, perhaps prompted by his wife's distaste for Washington life, and spent the next decade in legal practice and state politics. In 1846, he enlisted for the Mexican War.

Pierce's defense of the Compromise of 1850 against the New England Democrats' opposition to the Fugitive Slave Law (*q.v.*) won the regard of Southern party leaders. His handsome presence and fine manners made him a good platform figure. When Lewis Cass, Stephen A. Douglas, and James Buchanan (*qq.v.*) failed to win definitive support at the 1852 convention, Pierce be-

PIERRE

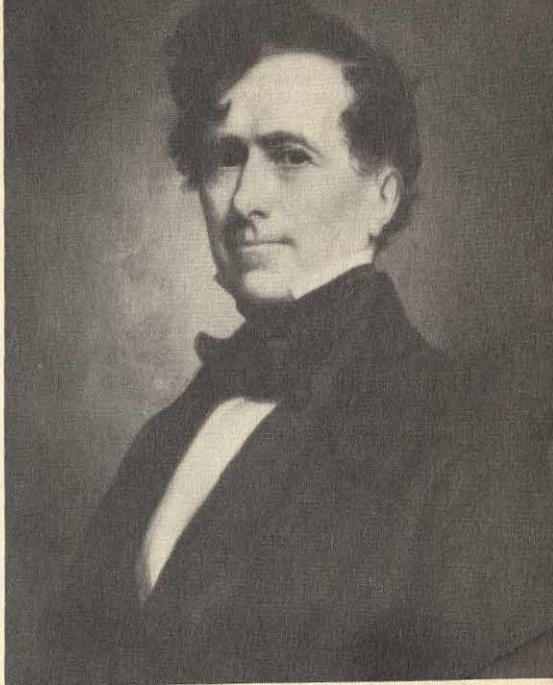
came the "dark horse" to win the race. The color of the campaign was given by the bolting Free Soilers, but Pierce carried the election.

In foreign affairs, Pierce during his term (1853-57) followed an expansionist policy, carrying through the Gadsden Purchase (*q.v.*) but failing to buy Cuba, secure a naval base in Santo Domingo, or annex Hawaii. He promoted expansion of commerce and Commodore Mathew C. Perry (*q.v.*), concluded a treaty with Japan which commenced the westerization of the Nipponese empire. Efforts to reorganize the armed forces and restore party harmony failed after Pierce signed the Kansas-Nebraska bill, repealing the Missouri Compromise (*qq.v.*), and leaving the status of slavery in the territories to the votes of their inhabitants. Pierce's effort to administer the law foundered on sectional antagonism and his inability to find officials who would refrain from illegal speculation in public land.

In spite of appeals for harmony and unity, Pierce could no more restore order in Kansas than he could understand why his fellow New Englanders found it a moral duty to defy the Fugitive Slave Law. In 1861, he appealed for a Conference of ex-Presidents to meet the crisis, gave Lincoln lukewarm support when that project failed, and died in opposition, unpopular, and obscure.

Pierre (*pēr*), the capital of South Dakota, county seat of Hughes County, near the central part of the state, on the Missouri River. It is on the Chicago & North Western R.R., on a fine site near Old Fort Pierre, at the mouth of the Bad River. The noteworthy buildings include the state capitol, the county courthouse, and many churches. It has a government industrial school for Indians, a municipal swimming pool, and St. Mary's Hospital. The surrounding country has large farming and stock-growing interests. Among the industries are railroad shops, granite works, grain elevators, and stockyards. Pierre was settled in 1880 and incorporated in 1890. Population, 1905, 2,794; in 1950, 5,715.

Pierrepont (*pēr'pōnt*), EDWARDS, jurist, born in North Haven, Conn., Mar. 4, 1817; died Sept. 23, 1892. He was graduated from Yale in 1837, completed a law course there in 1840, and soon established a successful practice in New York City. In 1857 he became judge of the superior court and in 1862 was appointed to try cases of parties confined in the prisons and forts under the U.S. government. He supported Abraham Lincoln for the Presidency, though he was a Democrat, and afterward prosecuted the trial of J.H. Surrat, one of the conspirators implicated in the assassination of President Lincoln. From 1869 to 1870 he was district attorney general in New York and in that capacity was an active opponent of the Tweed ring. President Grant selected him as Attorney



Courtesy N. Y. Historical Society

FRANKLIN PIERCE

Painting by George P. A. Healy (1813-94)

General in 1875, but in 1876 he resigned to become minister to England. Pierrepont wrote ably on international law.

Pietà (*pyā-tā'*), the Italian word for pity, used in art to refer to painting or sculpture which has as a subject the Virgin Mary lamenting over the dead Christ, whom she is holding, usually across her knees. The scene was depicted especially from the Romanesque through the baroque eras.

Pietermaritzburg (*pē-tēr-mār'its-búrg*), capital of Natal, South Africa, situated on a ridge above the Umsinduzi River and on the chief railway line between Durban and Johannesburg. The city has some industries and is in an agricultural area. Natal University Coll. is located here. Dutch pioneers founded the city in 1839, and it was named for two of their leaders. Population, 1958, 90,500.

Pietism (*pī'e-tīz'm*), a term designating a movement in the Lutheran Church in the 17th and 18th centuries. Pietism originated in Germany, inspired by Philip Jacob Spener (1635-1705), who was one of the founders of the Univ. of Halle. Spener, a Lutheran pastor, initiated informal religious meetings ("*collegia pietatis*") intended to overcome the rather paralyzing intellectualism and cold orthodoxy of the official Protestant Church. In the 17th century, Protestantism on the Continent, particularly in Lutheran Germany, had become rigid and formalistic, and Spener wanted to introduce a more experimental

Christianity. In his book, "*Piadesideria*" (1675), he advocated, among other reforms, greater attention to Bible study and a loving approach to, rather than arguments with, dissenters. The danger of his recommendations lay in undue subjectivity and weakening of loyalty to institutional religion.

The movement spread rapidly in conventicles from Halle, throughout Germany, Scandinavia, and Switzerland. August Francke (1663-1727) became one of the great leaders in Germany. In the 18th century, Count von Zinzendorf (*q.v.*) became a leading Pietist and effected a renewal of the almost extinct Bohemian Brethren (*q.v.*) to form the Moravian Church, a denomination widely spread in the U.S. Zinzendorf followed Spener and Francke on individual regeneration and intensity of personal emotion, in some respects approaching Catholic mysticism; his movement is generally called the Moravian Church where it exists in the English-speaking world and the Brethren's Church or "Herrnhuter" in Germany.

Since it was believed that the only tie which bound together the individual members of the community was the common love toward Christ, Pietism had no strict doctrine and was essentially characterized by high emotionalism. The movements which developed out of Pietism were almost identical with it. They spread first in Germany and later to England and the U.S. Menonites and Dunkards of Anabaptist origin have much in common with Pietists. Even Methodism was originally influenced by Pietism, since John Wesley (*q.v.*) met the Moravians when he sailed for Georgia.

On the whole, Pietism may be considered as one of the strongest spiritual revival movements among the Protestants, as a ferment which frequently stimulated the more formalistic and rational official churches. In its missionary work, it always emphasized brotherly love and a devotional life, in contrast to dogmatic formulas. In its earlier phase, Pietism was a reaction against the formalism of orthodoxy, while in the latter part of the 18th century it served as a protest against the coldness of the rationalism of the Enlightenment.

Pig (*pig*). See *Swine*.

Pigeon (*pij'ūn*), one of a large group of birds of the family Columbidae, most familiar of which is the urban domestic pigeon. The family includes many species, varying greatly in color. They are similar in habits and in their usually soft, smooth plumage, full breasts, and compact bodies. The crop is quite large in some species, and the bill is hard, with the upper mandible slightly curved at the point. The bird is sometimes called a dove (*q.v.*), although dove is more usually applied to the smaller members of the family. Besides the

hardy urban pigeon, which is probably descended from the rock dove of Europe, the most common pigeon of the U.S. is the mourning dove (*Zenaidura macroura*), often referred to as the turtle-dove. It is a migratory bird, spending its winters in the South and in Mexico and summering in the northern U.S. and Canada. Its gentle, cooing call and its devotion to its mate are well known. About a foot in length, it is a slender bird, grayish-blue to lavender on the back and wings, with a reddish-tan breast. The wings and the white-bordered tail have a few black spots. The dove's diet of seeds makes it a nuisance to farmers. There are eastern and western varieties. Among the domestic pigeons of the U.S. are the fantail, pouter, carrier, tumbler, and jacobin, many of them specifically bred for showing and racing. The passenger pigeon of the U.S., once abundant, is now extinct.

Although distributed in tropical and temperate climates, pigeons are most abundant in Australia and the Pacific islands. They perch in trees and prefer to build their poorly constructed nests on some other elevated object. Both male and female sit on the eggs, and they seem to pair for life. The young are fed on "pigeon milk," a substance secreted from the crops of the parents. The adult birds feed principally on various grains, seeds, and berries.

Pigeon raising for food is important in many countries. Specially raised young pigeons are sold for the table as squab when they weigh about three-quarters of a pound. For a description of the homing pigeon, see *Carrier Pigeon*.

Pigment (*pig'mēt*), one of the coloring materials used in painting and dyeing. Pigments are derived partly from natural substances and partly from artificial substances. The principal kinds of coloring substances are of mineral origin, and mineral coloring matters are usually added to substances derived from animals or vegetables. Most coloring substances used in painting are insoluble and are applied after having been ground and dispersed in oil or some other liquid, the liquid drying after application without changing the pigments. The main applications of pigments are in paints, plastics, textiles, rubber products, printing inks, paper, cement, ceramics, tile, linoleum, and rubber goods.

Pigments fall into five general categories: whites, blacks, extenders, colors, and metallic powders. Important white pigments are titanium dioxide, lead oxide, zinc oxide, lithopone, and leaded-zinc pigments. Black pigments are usually carbon types, which include channel black, thermal black, furnace black, lampblack, bone black, graphite, and vegetable black. Manganese and antimony blacks are inorganic types which have limited use. Extender pigments are talc, mica, aluminum silicates, and special clays.

PIGWEED

There are a variety of color pigments, which can be broken down into two classes: inorganic and organic. Inorganic colors are iron oxides, iron blues, ultramarine blue, chrome yellow, chrome orange, mercury-cadmium pigments, mercury oxide, raw and burnt siennas, cadmium orange and red, molybdate orange, and ochres. Included in the organic classification are phthalocyanine blue and green; indanthrene blue; rubine and toluidine pigments; para, lithol, rubine, and eosine toners; B.C.N. reds and maroons; benzidine oranges and yellows; pyrazolone red; hansa yellows; alizarin red; thioindigoid reds and maroons; and arylide maroon.

Aluminum and bronze powders are the two most important metallic powders used in paints.

Pigweed (*pig'wēd*), the popular name given to several plants in the goosefoot and amaranth families. The goosefoot species have starchy leaves which resemble, as the name implies, a goose's foot. The pigweeds all grow in waste ground, in any soil which will support vegetation. The *Amaranthus retroflexus* is a common pigweed which grows from Canada southward into the U.S. The species is an obnoxious weed in gardens and cultivated fields. It has small greenish flowers on spikes, dull green leaves, and a straight stem. Locally it is sometimes called *beetroot*, since its root has a reddish color. It requires careful cultivation to clear the soil of this weed.

Pika (*pī'kə*), the name of several rodent animals, frequently called *conies* or *calling hares*. They have short ears and no visible tail. The skull is very flat and dilated behind and the legs are short. In most respects they resemble the guinea pigs rather than the hares, but like the latter are timid and harmless. Several species are common to high mountains, including the *Rocky Mountain pika* of America. This animal is about 7 in. long and subsists on grasses, which it cuts and stores for fodder in the winter. The pika is hunted for its skin and meat.

Pike (*pīk*), a genus of fishes found in the fresh waters of Europe and North America, so called from the sharp snout and slender shape. Most species have a long body and flat back, and taper toward the tail with more than ordinary abruptness. Cycloid scales cover the body. The mouth is large, with the lower jaw projecting, and there is a large and powerful array of teeth. The dorsal fin is near the tail, by which it is aided in swimming with greater swiftness than any other fish. The common pike found in the rivers and lakes of North America occurs likewise in Europe and Asia and is of much value for its edible flesh. It rarely exceeds 3 ft. in length and weighs from 6 to 20 pounds. The largest species of pikes attain a length of from 3 to 6 ft. and live to a very old age. Specimens have been found in which the age was estimated at 250 years. Pikes are very



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PIKES PEAK

voracious and feed on almost any animal substance that they are capable of swallowing. The pike perch is allied to the perch, but resembles the pike in having a long head and body. It occurs in the Great Lakes and many of the streams of the Mississippi valley, where it is caught as a favorite food fish.

Pike, ZEBULON MONTGOMERY, soldier and explorer, born at Lamberton, N.J., Jan. 5, 1779; died Apr. 27, 1813. He accompanied his father to Pennsylvania, and under his command he became a cadet in a regiment, but was promoted to the rank of lieutenant in 1800. In 1805 he started for St. Louis to aid in exploring the Louisiana Purchase. He then set out for a tour through the Southwest, when he penetrated as far as the Rio Grande, where he was imprisoned by the Spaniards, but was soon released. He was rapidly promoted, becoming major in 1808, and in 1813 commanded an expedition sent against York (now Toronto) Canada. He was killed in action while making an assault upon the place.

Pikes Peak (*pīks pēk*), an elevated summit of the Rocky Mts., situated in Colorado, near Colorado Springs. It was discovered by Gen. Z. M. Pike (*q.v.*), in 1806, while making explorations to find the source of the Mississippi. The mountain is rich in gold deposits, has a meteorological observatory, and is 14,134 ft. high. Numerous resorts lie in its vicinity. A cog railway was built to its top in 1891, which is 9 m. long and con-



Courtesy New York Public Library

PILGRIMS GOING TO CHURCH

Painting by G. H. Boughton (1833-1905)

nects the summit with Manitou Springs, a summer resort near its base.

Pilate (*pī'lat*), PONTIUS, fifth Roman procurator of Judea, who succeeded Valerius Gratus to that position in 26 A.D. He was a Roman *eques* by rank and had his residence as procurator at Caesarea, but during festivals visited Jerusalem, where he presided over various bodies as official. Writers generally agree that Pilate was alike indifferent to justice and mercy, and that he was narrow-minded in the administration of the law. When the Jewish priests had condemned Christ to be executed, they took him to Pilate, for the reason that the power to inflict capital punishment was not vested in them. Though Pilate protested the innocence of Christ, he permitted the Jews to crucify him, but afterward consented that his body be buried by Joseph of Arimathea. It is not certain what became of Pilate, but the best authorities indicate that he was removed from office in 36 A.D. and banished to Vienna by Caligula. According to tradition, Pilate afterward committed suicide. Pilate's wife was a secret disciple of Jesus and is commemorated as a saint in the Greek Church.

Pilchard (*pīl'chērd*), a fish of the herring family. It is about as large as a herring, but is somewhat thicker and the scales are larger. Young pilchards are known as sardines. Vast schools of pilchard occur in the Mediterranean and the Atlantic coast of Europe, where this fish is caught by means of seines for the market and for preserving purposes. Pilchard fisheries occur on the shore of the English Channel, but not elsewhere in Great Britain. The most important fisheries are

off Cornwall, where many thousands of hogsheads are taken annually.

Pilcomayo (*pēl-kō-mā'yó*), a river of South America, the largest tributary of the Paraguay. The source is in the vicinity of Sucre, Bolivia. After a circuitous course of about 1,500 m. toward the southeast, it joins the Paraguay below Asunción. It forms the boundary between Paraguay and Argentina. Forests of great value abound in its valley, but its navigation is obstructed in dry seasons.

Pile (*pīl*), a post of timber or iron driven into the ground, either upon the land or under water, to serve as a foundation of any structure. The simple form of the pile consists of a straight tree, which is pointed at one end and banded at the other to protect it from the shattering effect of the blows by which it is driven downward. An iron point is sometimes fixed to the lower end, as an aid to permit penetrating hard substances, or a metal cap in the form of a screw is adjusted, permitting it to be sunk into the muddy or sandy bottom by turning. Piles are commonly driven by hammerlike machines called pile drivers.

Pile, in physics. See *Uranium*.

Piles (*pīlz*). See *Hemorrhoids*.

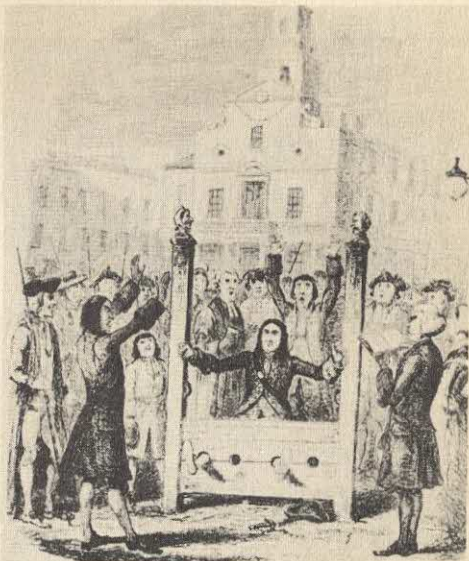
Pilgrim Fathers (*pīl'grīm fāTH'ērz*), the name generally applied to the Nonconformists who sailed from Southampton, England, in the *Mayflower*, and landed in the vicinity of what is now Plymouth, Mass., on Dec. 21, 1620. A party of Puritans left England in 1608 because of constant religious persecutions and settled in Holland. As they were unwilling to conform to the customs of Holland, they sent John Carver and Robert

Cushman as commissioners, in 1617, to treat with the Virginia Co., then located in England, for territory in America. The whole company sailed from Delft Haven in the *Speedwell* to Southampton, where they embarked in the *Mayflower* for America on Aug. 5, 1620. It was the intention of the passengers, a total of 102, to land near the mouth of the Hudson River, but they were driven farther north by the wind. The leaders of the pilgrims were Carver, Cushman, Bradford, Brewster, and Miles Standish. A compact of government was written and signed before landing and this document is regarded as the first written constitution of which there is a historical account. The pilgrims are remembered by a monument at Plymouth, by Forefathers' Day, and by a Pilgrims' Hall erected under the direction of a Pilgrims' Society. See also color plate, *American Costumes*, Volume IV.

Pillbox (*pil' bōks*), colloquial military term for a gun emplacement, generally constructed of steel or reinforced concrete. Used for defense purposes, the pillbox is designed to protect one or more guns and crews from enemy weapons. Pillboxes usually house weapons of automatic or semi-automatic action such as machine guns, but may also house larger weapons such as anti-tank guns. They are usually permanently situated. Gun ports or embrasures are generally designed to permit frontal and flanking fire, the latter advantageous in providing mutual support with other emplacements in a defensive line. Examples of pillboxes and their use may be found in practically all modern fortifications (*q.v.*).

Pilling (*pil' ling*), JAMES CONSTANTINE, bibliographer, born in Washington, D.C., Nov. 16, 1846; died in Olney, Md., July 26, 1895. He studied at Gonzaga Univ., Spokane, Wash., secured clerical work in various committees of Congress, and in 1880 became chief clerk of the U.S. Geological Survey. In 1891 he was selected as ethnologist of the Smithsonian Institution. His writings are devoted largely to bibliography and ethnology.

Pillory (*pil' lō-rĭ*), a wooden frame designed for the punishment of offenders and criminals. This mode of punishment was formerly of common use in England, but it was abolished there in 1837. It was employed principally for the punishment of those guilty of perjury, forgery, libel, petty larceny, and unjust weights, and for some time it was used in punishing common scolds and brawlers. The pillory consisted of a frame of wood, erected on a pillar or stand, with movable boards containing holes in which the head and hands of the offender were put. When in this position, the offender was exposed to the public view and insult, this constituting the principal punishment. Another similar implement, the *stocks*, consisted of a frame of timber with holes for the feet, or the feet and hands. A modified



Courtesy Bettmann Archive, N. Y.

PUNISHMENT AT THE PILLORY

Engraving by George Cruikshank (1792-1878)

form of the pillory is still used in a number of Asiatic countries. It was employed to a limited extent in the early English settlements of America.

Pillow (*pil' ō*), GIDEON JOHNSON, soldier, born in Williamson County, Tenn., June 8, 1806; died Oct. 6, 1878. He studied at the Univ. of Nashville, from which he was graduated in 1827, and took up the practice of law at Columbia. In 1846 he became a brigadier general of Tennessee volunteers in the Mexican War, was wounded while commanding at Cerro Gordo, and took part in the Battles of Molino del Rey and Chapultepec. Afterward he again practiced law, but in 1861 raised a regiment for service in the Confederate Army. He commanded at Belmont against Gen. Grant and was second in command at Ft. Donelson, but left the place before it was surrendered. Afterward he operated in the southwest with Gen. Beauregard.

Pillsbury (*pilz' bēr-ĭ*), CHARLES ALFRED, miller, born in New Hampshire in 1842; died Sept. 17, 1899. He settled at Minneapolis, Minn., and in 1872 organized a company that built the largest flour mills in the world. These mills were sold to an English syndicate in 1889, which came into possession of the famous Pillsbury-Washburn mills, and the entire system was placed under a board of directors of which Pillsbury became president. He built many elevators and other large structures in which improved machinery was placed. The facilities installed by him for crushing and disintegrating wheat by means of steam rollers not only cheapened flour, but greatly improved its quality. Pillsbury was the owner of profitable patents on a number of improved de-

vices. He served as a Republican in the senate of Minnesota from 1877 until 1887.

Pillsbury, JOHN SARGENT, businessman and politician, born at Sutton, N.H., July 29, 1828; died Oct. 18, 1901. He received a public school education in his native state, and in 1855 went to Minnesota and engaged in the hardware business at St. Anthony, now Minneapolis. His business proved successful, owing to the rapid development of the Northwest, and he invested largely in lumber and forest interests. In 1872 he joined the firm of Charles A. Pillsbury & Co., which became owner of the largest flour mills in the world. He served as state senator from 1864 until 1876 and was governor of Minnesota from 1876 until 1882. Besides erecting Science Hall for the Univ. of Minnesota at a cost of \$150,000, he founded a workingman's library in Minneapolis, and built a town hall in his birthplace, Sutton, N.H.

Pilot (*pi'lūt*), an officer licensed by law to conduct vessels in and out of port, or within a particular district, designating the courses to be steered. Pilotage in the U.S. is controlled by Congress, but the individual states are granted power to make particular regulations. A system of this kind has been found necessary in all countries, since there are always points of difficulty and danger near the shores and where ships are to land, it being the duty of the pilot to superintend the steering of the vessel so that the dangerous channels may be avoided. In many of the large seaports compulsory pilotage has been abolished and some of the states have greatly modified the system, though some insurance companies still require employment of a pilot by a clause in their policies. In aeronautics, one who directs an airplane, airship, etc.

Pilot, or **PILOT FISH**, a fish which somewhat resembles the mackerel, but differing from it in having no finlets back of the dorsal fin. The adult is about 2 ft. long, has five cross bands of black, and the general color is grayish-blue. Though not sold extensively in the markets, it is prized for its fine flavor.

Pilsen (*pi'l'sen*), or **PLZEN**, a city of Czechoslovakia, in Bohemia, on the Mies and Radbusa Rivers, 52 m. s.w. of Prague. Among the manufactures are clothing, beer, paper, leather, machinery, stoves, earthenware, and enameled tinware. Several extensive iron and glass works are in the vicinity. The celebrated Church of St. Bartholomew was built in 1292. It was occupied by a Prussian army in 1866 and by the Germans, 1939-45. Population, chiefly Czechs, ca. 135,000.

Pilsudski (*pi'l-sōōt'skē*), JÓZEF, statesman and soldier, born near Vilna, Poland, in 1867; died on May 12, 1935. He was banished to Siberia on account of an alleged plot to assassinate Alexander II, Czar of Russia and one-time ruler of Poland. Returning to Poland after five years of exile,

he became a leader of the Polish Socialist Party (1892) and started a secret radical paper, *Robotnik* (*The Workman*); in 1900 he was arrested together with his wife, Marie Tuskiewicz, but they managed to escape to England. When he returned to Poland in 1902, he again followed his political agitations, secretly building a private Polish army. At the outbreak of World War I, he put into the field an army of about 10,000 men which he commanded against Russia. He resigned in 1916. Taken prisoner by the Germans (1917-18) he returned to Warsaw after the defeat of the Central Powers, and with the assistance of his army, was elected chief of state and generalissimo of the newly formed Polish republic and army, respectively. He resigned in 1922. Four years later, while in the official capacity of minister of war, he became dictator of Poland through a *coup d'état*. Retaining the ministry of war, he acted also as premier from 1926-28, and again in 1930. He remained the leading power in Polish policies until his death.

Piltown Man (*pi'l'toun mān*), name applied to the skull of a prehistoric man found at Piltown, Sussex, England, in 1912, by Charles Dawson and Smith Woodward. Originally claimed to be a 500,000-year-old skull, it was re-examined (1953) and its age given at ca. 50,000 years by British scientists. They alleged that the earlier findings were due to fraud, and that the jawbone and tooth of an ape of undetermined age had been mistakenly attached to the skull. See also *Pre-History*.

Pimento (*pi'm-ēn'tō*), or **PIMIENTO**, also known as *all-spice* or *Jamaica pepper*, a West Indian berry with deep green leaves, white flowers and dark purple berries. It is widely used as a spice.

Pimpernel (*pi'm'pēr-nēl*), a flowering plant of the primrose family, native to Europe and common in regions of North America. The scarlet pimpernel (*Anagallis arvensis*) is a delicate annual with low, spreading leaves and scarlet, or—rarely—white, bell-like flowers. The plant is known as the "poor-man's-weatherglass," because its flowers close when the weather becomes damp. See also *Orczy*, *Emmuskā*.

Pin (*pīn*), a short piece of wire, with a rounded or flattened head and a sharp point, in common use for fastening together pieces of paper or fabric. Almost as common is the safety pin, in which the wire is bent to form a spring and the point is held in a guard at the end where the head would ordinarily be. Early examples of the straight pin were slightly altered fishbones or thorns; later pins, some resembling the modern safety pin, were made of copper or bronze. Pins of brass or iron were made by hand and enormously expensive in medieval Europe. In England, in the 14th and 15th centuries, special allowances were made to wives for buying

pins. This allowance, known as "pin money," was later expanded to cover all of a wife's personal expenditures. The manufacture of pins by machine was made possible by Lemuel Wright, of Massachusetts, who patented his pin-making machine in England in 1824. By the 1830's, the industry had been established in the U.S.

Pinar del Río (*pên-nâr' Thêl rê'ô*), a province of Cuba, situated in the westernmost part of the island. It is 5,212 sq. m. in area and is principally an agricultural province. The capital city is Pinar del Río (pop., 26,241), which is served by the Western Ry. of Havana and the Central Highway. It is 111 m. from Havana. The products include tobacco, coffee, cane, pineapples, and cattle. There are huge asphalt deposits at Mariel and Bahía Honda, iron and copper mines near Mantua, and rich mineral deposits in other parts of the province which have not yet been exploited. Population, *ca.* 400,000.

Pinchbeck (*pinch'bêk*), an alloy of copper and zinc, usually made to resemble some of the baser alloys of gold. It contains about 20 parts of zinc and 80 parts of copper, and is used to some extent in making watch cases and other articles in imitation of gold.

Pinchers (*pinch'êrz*), a tool with two handles and two grasping jaws that work on a pivot. It is used for gripping things which are to be held fast, for cutting wire, and for drawing nails. Those used for cutting wire are called *nippers* and small pinchers are known as *pliers*. The latter are sometimes modified for punching holes in paper and leather, being constructed so one of the jaws has a hollow punch with a cutting edge.

Pinchot (*pîn'shō*), GIFFORD, political leader, born at Simsbury, Conn., in 1865. After several years of forestry study in Europe, he introduced professional forestry in the U.S. (1892), later heading the Dept. of Agriculture's Forestry Division (1898-1910), and holding a professorship of forestry at Yale Univ. (1903-36), where, with his brother Amos, he founded the Pinchot School of Forestry. He was removed from the Forest Service by President Taft for insubordination in a dispute with the Secretary of the Interior, R.A. Ballinger. Pinchot was Pennsylvania forest commissioner (1919-22), and twice governor of the state (1923-27 and 1931-35). In addition to a number of books on forestry, Pinchot wrote "To the South Seas" (1930) and "Just Fishing Talk" (1936). He died Oct. 4, 1946.

Pinckney (*pink'nî*), CHARLES, statesman, born in Charleston, S.C., Mar. 9, 1758; died Feb. 22, 1824. He took up the practice of law in 1779, but was elected to the Continental Congress. In 1778 he was a delegate to the Federal convention and served as governor of South Carolina from 1789 to 1792 and from 1796 to 1798. He was elected U.S. Senator as a Democrat in 1797, be-

came minister to Spain in 1803, and served as governor of South Carolina from 1806 to 1808. Subsequently he was a member of the state legislature and later of the national House of Representatives. He advocated a system of free schools in his state. Pinckney was a close friend of President Jefferson.

Pinckney, CHARLES COTESWORTH, statesman, cousin of the above, born in Charleston, S.C., Feb. 25, 1746; died Aug. 16, 1825. He studied in South Carolina and in England, was attorney general of the colony of South Carolina, and became a member of its provincial congress in 1775. His efforts were favorable to the colonists and he became the aide-de-camp of Washington, serving with him in that capacity at the Battles of Brandywine and Germantown, but soon after took charge of a command as colonel. In 1780 he was taken prisoner at the surrender of Charleston and was detained by the British until the war closed. He was a member of the Federal convention in 1787 that framed the Constitution of the U.S., and in that body opposed making religion a test of qualification for office. President Washington appointed him minister to France in 1796, but the French Directory refused to receive him, since a war was threatened at that time between France and the U.S. However, the French agents attempted to bribe him and Pinckney made his famous reply, "Millions for defense, but not one cent for tribute." He was later appointed major general and was the unsuccessful candidate of the Federalist party for Vice President in 1800 and for President in 1804 and 1808.

Pinckney, THOMAS, soldier and diplomat, brother of the above, born at Charleston, S.C., Oct. 23, 1750; died Nov. 2, 1828. He studied law in London, England, and joined the Revolutionary Army on returning to America. At Camden he was severely wounded in 1780, and remained a prisoner until the close of the war. In 1787 he was elected governor of South Carolina and in 1792 became minister to England. He was sent to Spain in 1794 to negotiate a commercial treaty, which resulted in concluding, in 1795, the agreement that navigation on the Mississippi was to be free to the U.S. In 1796 he was the Federalist candidate for Vice President. Later he served a term in Congress and commanded as major general in the War of 1812. At the Battle of Horseshoe Bend he defeated the Creek and Seminole Indians.

Pindar (*pîn'dâr*), celebrated Greek lyric poet, born near Thebes about 522 B.C.; died in 443 B.C. He was descended from a noble family, and under the direction of his father developed much skill in music, but his talent for poetry caused his father to send him to Athens for instruction under Lasus of Hermione, founder of an Athenian school of poetry. He returned to Thebes in 502 B.C.,



PINDAR

where he was further instructed by Corinna and Myrtis, two famous poetesses of Bœotia. His remarkable genius soon attracted the attention of many celebrated Hellenic rulers, and he was everywhere honored because of his scholarly and well-adapted compositions. Among his choral songs are a number composed for Alexander I, King of Macedonia, Hiero, tyrant of Syracuse, and Arcesilaus, King of Cyrene. Most of his life was spent at the courts of kings and in witnessing festive games. To all of these he devotes attention in his poetical works.

Only fragments of his works, such as "Hymns," "Paeans," "Dithyrambs," "Dirges," are extant. However, his 44 "Epinicia," odes of victory, are preserved in entirety. They recount the victories won at the Pythian, Olympian, Isthmian, and Nemean games, not only celebrating the achievements, but also intermingling choruses and pious devotion to the gods. The Athenians held him in special esteem, since he showed a particular fondness for them, who "laid the shining foundations of freedom."

Pindar, PETER. See *Wolcott, John*.

Pine (*pin*), the name popularly applied to any tree of the genus *Pinus*. The trees of this group are distinguished by their woody cones and numerous two-seeded scales from the spruces, larches, firs, cedars, and other trees of the same family, but of a different genus. The leaves are evergreen and needle-shaped, and vary in length from about an inch to more than a foot. They grow in small clusters of from one to five, according to the species, and are sheathed at the base by thin, chafflike scales. The leaves are so shaped at the inner and outer faces that they make a solid cylinder when pressed together. Pines are practically confined to the Northern Hemisphere, where they grow in extensive groves in America, Europe, and Asia, but a distinct species is found in the Canary Islands. They thrive

PINE

most abundantly in the temperate and cold regions and are rarely found in the Torrid Zone. In size they range from mere shrubs to stately trees fully 300 ft. high. The pines are found mostly in groves and extensive forests.

The pine forests of the tropical regions are confined to the elevated mountains, while in the northern and colder climates they grow vigorously at sea level, though those confined to the Arctic Zone are mere shrubs. Seventy species have been described, of which 35 are native to North America, but only a few of these have more than local importance for lumbering purposes.

The *white pine* and *yellow pine* are the most important of all the American species and are found in abundance in the western and southern regions of the U.S. and northwestward into Canada.

The Western pines number three—two genuine *white pines*—and all are used extensively in the construction of buildings and furniture. *Idaho white pine* grows most abundantly in the "Inland Empire" region of northern Idaho, western Montana and eastern Washington. The mature trees are from 150 to 180 ft. tall and from 2 to 4 ft. in diameter. The bark is thin and dark grayish in color; needles are about 4 in. long in clusters of five, and the slender cones are from 6 to 12 in. long and have thin scales. *Sugar pine*, second of the genuine *white pines*, is found only in California and southern Oregon. Largest of the entire pine family, the trees average 5 ft. in diameter, sometimes reaching 12 ft., and tower to 250 ft. in height. Cones up to 20 in. and more in length hang from the upturned tips of long branches and the bark is cinnamon or red-brown in color. *Ponderosa pine* is greatest by volume of the Western pines and is found in 12 western states, including South Dakota. Trees grow to 8 ft. in diameter and 200 ft. high but average 3 to 4 ft. across and 150 ft. or less in height. Trunks are straight and bark is yellowish brown. Needles grow in clusters of three, usually from 4 to 6 in. long, and the cones, which require two years to mature, are from 3 to 5 in. long. The Western pines cover an area of about 110,000,000 acres on which 630,000,000,000 board feet of timber, 340,000,000,000 of it pine, stand. The Western pines have in common a soft, even texture, approximate strength characteristics, and utility in all types of construction.

Northern pine, a genuine *white pine*, and *Norway pine*, a *yellow pine*, were once abundant in the north central U.S. but no longer exist in commercial sized stands. Another lofty tree, the *loblolly pine*, has long leaves and is widely distributed in North America.

The *yellow pine*, so-called because of the yellowish color of its wood and bark, is found in

some 19 Southern states from Southern New Jersey to Texas, and is known in commercial lumber markets as *Southern pine*. There are nine species of *yellow pine*, of which four are of special commercial value. The others are economically unimportant because they grow in scattered and sparse stands, are small in size, and produce only small quantities of lumber. The four important species, in the order of their value from the standpoint of quality and abundance, are longleaf pine (*Pinus palustris*), shortleaf (*P. echinata*), loblolly pine (*P. taeda*), and slash pine (*P. caribaea*). The preponderance of Southern pine production, which annually amounts to about a third of the national lumber production in the U.S., comes from these species. All of them, plus the less popular yellow pine species, are included in the term *Southern pine*. There is more lumber produced annually in the U.S. from Southern pine than from any other species of wood. The pine forests of Europe are most extensive in the Alps, the Pyrenees, and the Vosges, and there are vast forests in Russia and the Scandinavian peninsula. Large forests of pines occur in the Himalayas and other sections of Asia. The *Scotch pine* is a native of Western Europe and has been naturalized and planted extensively in America as an ornamental tree, because of its colorful foliage and spreading branches.

Pineal Gland (*pin'ē-āl glānd*) OF PINEAL BODY, a conelike mass of tissue found in man and most animals. About $\frac{1}{4}$ in. long, it is situated at the base of the brain. It is supposed, by some, to be the remnant of a third eye; Descartes (*q.v.*) called it the "seat of the soul." Its actual function has not been proven, but there are reports of sexual overdevelopment in boys in whom tumors of this gland have been found.

Pineapple (*pin'āp'l*), the fruit of a tropical American plant, *Ananas comosus*, of the pineapple family. The pineapple fruit consists of a large, cone-shaped cluster of fleshy, sterile flowers arranged in a spiral. The edible part is made up of the flowering stem together with the swollen flower parts. The fruiting head is borne on an erect stalk, which rises from a circle of spiny leaves, 2 ft. or more in length. New plants are raised from cuttings of the tuft of leaves which tops the fruit or from small branches which arise lower down. In wild forms of the pineapple, perfect flowers are produced. The pineapple plant is one of the few kinds among hundreds in its family which grow in soil, most being air plants.

While a native American plant, pineapples are now widely cultivated throughout the tropics. The juice of raw pineapples contains a digestive ferment which, with that of another tropical fruit, papaya, is used for "tenderizing" meats.

Pine Bluff (*pin blūf*), county seat of Jefferson

County, Arkansas, about 40 m. s.e. of Little Rock. It is on the Arkansas River and the Missouri Pacific and St. Louis Southwestern R.R.'s. It is the center of a rich agricultural region and carries on an extensive trade in cotton, livestock, cereals, and tobacco. Pine Bluff's manufactures include flour, lumber products, cotton goods, leather, farm machinery, and railroad shops. The town is the seat of the Arkansas Agricultural, Mechanical, and Normal Coll. Settled by French traders in 1819, Pine Bluff was incorporated in 1846. Population, 1940, 21,290; in 1950, 37,162.

Pinehurst (*pin'hūrst*), a winter resort in Moore County, North Carolina, about 63 m. s.w. of Raleigh. The community is privately owned and is not incorporated. It is well known for its golf courses and as winter quarters for race horses. Population, 1950, 1,016.

Pinel (*pē-nēl'*), PHILIPPE, physician, born in St.-André, Tarn, France, April 20, 1745; died in Paris, Oct. 25, 1826. He was educated at the Univ. of Toulouse and then went to Paris, where he began translating medical treatises. In 1791, however, there appeared his own "*Traité médico-philosophique sur l'aliénation mentale*" ("Medico-Philosophical Treatise on Insanity"), which outlined his views on the proper treatment for the insane. In the following year, at an asylum in Paris, he put his theories into practice. In 1794 he was made head physician of the Salpêtrière, another Paris asylum. He eventually became professor of pathology at the School of Medicine at Paris.

He saw to it that many unnecessary cruelties toward the mentally ill were abandoned, insisted that they be treated with kindness, and he was the first to use occupational therapy with mental patients. He also anticipated modern psychiatric practice by keeping detailed case histories for purposes of research.

Pinero (*pī-nēr'ō*), SIR ARTHUR WING, dramatist, born in London, England, May 24, 1855; died there, Nov. 3, 1934. Leaving school at the age of ten, he was apprenticed to the law, a profession he hated and from which he escaped in 1874 by becoming an actor. For seven years he was on the stage, acting in modern plays and in Shakespearean productions and gaining much practical stage experience. His first play, "*£200 A Year*," was produced in 1877 and was followed by such successful farces as "*The Money Spinner*" (1880), "*The Magistrate*" (1885), and "*Sweet Lavender*" (1888). With "*The Profligate*" (1889), Pinero turned to the kind of serious, realistic drama for which he is best remembered. In 1893 he produced his most famous play, "*The Second Mrs. Tanqueray*," with Mrs. Patrick Campbell in the leading role. A drama of marital infidelity, the play excited considerable discussion; it



ARTHUR W. PINERO

Courtesy Brown Bros., N. Y.

has been translated into many languages.

Pines (*pīnz*), ISLE OF, an island of the West Indies, situated 30 m. s. of Cuba, in the Caribbean Sea, constituting the principal island of the Archipelago de Los Canarros. It is 61 m. long by 55 m. wide. The area is 982 sq. m. The coast has several prominent indentations and near its shore are numerous smaller islands. It is in effect two islands, connected by a marsh. In the northern part the surface is diversified by a number of mountains and in the southern it is low, flat, and sandy, but there are plains of great fertility. It is visited as a health resort because of its favorable climate and mineral springs. The products include tobacco, cattle, cotton, cereals, vegetables, and fruits. Excellent forests are abundant, including pine, cedar, mahogany, and other woods. Rock-crystal, marble, and other minerals are obtained in the mountains. The local seat of government is at Nueva Gerona, but it has been a dependency of the province of Havana, Cuba, for many years. Columbus discovered the Isle of Pines in 1494. Population, ca. 4,000.

Pine Tree Flag (*pīn trē flāg*), first used in New England as an American colonial flag as early as 1700. The background of these early flags was either a solid red or blue, decorated with a representation of a pine tree, around which was coiled a serpent; below was the motto, "Don't tread on me," while above was written "An Appeal to Heaven." The pine tree flag, sometimes varied and combined with others, was used in defiance of the British government. About 1776, the pine tree and the second motto were generally shown on a white background. The pine tree flag was displayed by the earliest American vessels during the Revolution, but was replaced by the official American flag after June 14, 1777. See also *Flag*.

Ping-Pong (*pīŋ'pōŋ*). See *Table Tennis*.

PINNACE

Pingree (*pīn'grē*), HAZEN SENTER, manufacturer and politician, born in Denmark, Me., Aug. 30, 1840; died Oct. 18, 1901. He was the son of a poor farmer and worked in a cotton factory.

In 1862 he enlisted in the Federal Army. Immediately after the war he founded the shoe firm of Pingree & Smith at Detroit, which became one of the largest manufacturing establishments of the Northwest. He was elected mayor of Detroit as a Republican for four terms. He was governor of Michigan from 1896 to 1900.

Pink (*pīnk*), an extensive genus of plants, many of which have long been cultivated in gardens for their flowers. The numerous species, about 300, include both annuals and perennials. Florists generally group the pinks into three general classes—the *flakes*, *bizarres*, and *picotees*. A familiar species is generally known as the *garden pink*, or *peasant's-eye*. Many species have been grown as ornamental plants for ages and have been greatly improved by propagation. Those most extensively cultivated and best known are the *garden pink*, *clove pink*, and *carnation*, while the *sweet William* is sometimes classed with the clustered flowering plants of this class. Pinks are native to the regions of the Mediterranean, but a single species is found in the west central part of North America. Those now cultivated in gardens have been acclimated by importation from Europe.

Pinkerton (*pīn'kēr-tūn*), ALLAN, detective, born in Glasgow, Scotland, Aug. 25, 1819; died in Chicago, Ill., July 1, 1884. He emigrated to Canada in 1840 and later went to Chicago, where he became a deputy sheriff. He was appointed a detective of the Chicago police department in 1850, after which he originated the celebrated Pinkerton Detective Association. The plot to assassinate President Lincoln while proceeding to Washington was discovered by him, and at the beginning of the Civil War he became chief of the secret service of the Federal Army. To him is due the credit of discovering many secret plots, and he broke up the Molly Maguires in Pennsylvania. He wrote several books, including: "Railroad Forgers and the Detectives," "Spiritualists and the Detectives," "Gypsies and the Detectives," "Spy of the Rebellion," "Strikes, Communists, Tramps, and Detectives," and "Thirty Years a Detective."

Pink Eye (*pīnk ī*), in medicine, a contagious conjunctivitis occurring mainly among horses. Also, an acute contagious conjunctivitis affecting man and frequently occurring in epidemic form among children of school age.

Pinnace (*pīn'as*), a large boat carried by ships, usually from 28 to 32 ft. in length. It is somewhat larger than the cutter and smaller than the launch, and is operated by sails. The name is sometimes applied to a single-masted vessel hav-

ing oars or sweeps. A vessel of this class is capable of carrying from 60 to 80 tons and is employed by some nations for coast defense.

Pinnipedia (*pîn-î-pe' dî-â*), a suborder of carnivorous fin-footed mammals comprising the sea lions, walruses, and true seals (*q.v.*). This subdivision of the order Carnivora has a world oceanic distribution, though most abundant in the colder regions of the Northern and Southern Hemispheres. They are adapted for an aquatic life but pass part of their existence on the seashore or on floating ice and are capable of some progress on a solid surface. They are more or less covered with hair or fur and are streamlined for a rapid motion in the water. Both fore and hind limbs are present and modified into finlike flippers for swimming. They feed on fish, shellfish, crustaceans, squid, and in some instances prey on warm-blooded animals. Although lacking the actual speed of whales and some of the large fish, they equal, if they do not surpass, all aquatic forms of life in agility. They can dive into boiling surf pounding on ragged rocks in a stormy sea with perfect safety and can spend months at sea far from land. The suborder Pinnipedia is separable into three families: Eared seals, including the fur seals and sea lions (*Otariidae*); walruses (*Odobenidae*); and the hair or true seals (*Phocidae*).

Pinochle (*pe'nûk'l*), a card game played by two, three, or four players. The deck consists of 48 cards, being two each of all bridge colors and suits above the eight. The game was invented in America in the 19th century, and was probably designed as a modification of the older beziq.

Pinto (*pên'tô*), ALEXANDRE SERPA, soldier and traveler, born in Douro, Portugal, Apr. 20, 1846; died Dec. 28, 1900. He received his education at the Royal Military Coll., Lisbon, and soon after entered the Portuguese army in South Africa. He took part in the Zambezi War in 1869 and in 1877 entered upon an expedition to cross Africa from Benguela to Durban, reaching the latter place in 1879. The following year he became aide-de-camp to the King of Portugal and subsequently made a number of exploring expeditions through Southern Africa. He published "How I Crossed Africa" and was fittingly honored by many scientific and geographical societies.

Pinturicchio (*pên-tô-rêk'kê-ô*), BERNARDINO, painter, born in Perugia, Italy, in 1454; died in 1513. He studied under Fiorenzo di Lorenzo and for some time was associated with Pietro Perugino. As a decorative artist he excelled and his portraits and historical paintings are generally admired. He painted some frescoes in the Sistine Chapel and the Borgia apartments of the Vatican, and planned a number of architectural structures in Rome. He executed noted portraits of Isabella the Catholic, Pius II, and Innocent VIII. His most famous work is the "History of Pius II," painted

in 10 compartments in the library at Siena, in which he was assisted by Raphael.

Pinza (*pîn'zä*), EZIO, singer, born in Rome Italy, May 18, 1892; died in Stamford, Conn., May 9, 1957. Educated in Ravenna and at the Conservatory of Bologna, he made his debut as a basso in Rome in 1919. Successful in opera and concert in Europe, he came (1926) to the U.S., where he sang with the San Francisco, Chicago, St. Louis, and New York Metropolitan opera companies. Pinza, who was acclaimed for the dramatic spirit and consistently high quality of his performances in a wide variety of operatic roles, appeared (1949 *et seq.*) on Broadway and in television and motion pictures with much success.

Pinzon (*pên-thôn'*), MARTIN ALONSO, Spanish navigator, born in Palos, Andalusia, about the middle of the 15th century. As commander of the *Pinta* he took part in the voyage of Christopher Columbus (1492). It was on his suggestion that Columbus changed his course from due west to southwest and arrived at San Salvador, in the Bahamas (Oct. 12, 1492). Pinzon then sailed alone and discovered Haiti (Dec. 6, 1492), later rejoining Columbus.

Pipal (*pe'pûl*). See *Bo Tree*.

Pipe (*pîp*), an apparatus used by smokers of tobacco and other narcotics. It has two essential parts, the bowl and the stem. The former is the receptacle in which the substance is burned and the latter serves to draw the smoke into the mouth. Many kinds of pipes are in use and the materials from which they are made differ greatly, but usually clay or wood is used in constructing the cheaper grades. The finest pipes are made of meerschaum, a kind of compact magnesium stone, and of carved briar wood. Pipestems are usually made of different material from the bowls, in many cases of wood, bone, ivory, or amber and usually these materials form the mouthpieces. Most pipes in common use have stems of hard rubber, sometimes called vulcanite. The American Indians made pipes of baked clay and soapstone and in most cases made the stems of wood. Pipes made wholly of baked clay were of frequent manufacture among primitive peoples. Many of the relics found with the remains of the moundbuilders include such pipes.

Pipe, an artificial tube or conduit used to convey liquids, such as gas, steam, water, and petroleum. A variety of materials are used in the construction of pipes, but they consist principally of lead, iron, brass, copper, gutta-percha, and clays. In size they differ greatly, ranging from 1 in. to 5 ft. in diameter, though the larger sizes are principally of vitrified clays. Lead pipes are usually small and are employed chiefly for conveying water or steam for short distances. Mains used in waterworks are largely of iron, while sewage and drainage are conducted through pipes or tiles

made of a specially hard clay called fire clay.

Petroleum oil and natural gas are conveyed great distances through pipe lines and often under high pressures, though sometimes by the force of gravitation. The first line of this kind in America was constructed about 1875 from the oil fields in Pennsylvania to Pittsburgh, the pipes having a diameter of 4 in. and the lines a length of 55 m. A line was soon after built from Beaumont to the refineries at Port Arthur, Tex., and later a line was constructed from the oil fields of Oklahoma to the refineries at Port Arthur. Many of these lines are extensive. An 8 in. pipe line from Lima, O., to Chicago has a length of 205 m. The line from Olean to the Atlantic coast city of Bayonne, N.J., is over 300 m. long, while the one from Colgrove to Philadelphia has a length of 235 m. In 1925 there were about 50,000 m. of pipe lines for transporting gas and mineral oils in the U.S. Similar lines are utilized in Canada, Italy, Russia, Iran, Iraq, and other countries.

In July 1943, a 1,450 m. pipe line, known as the "Big Inch," was completed, enabling the pumping of oil from the southwestern oil fields to the east coast. The 24 in. seamless steel tubes run underground from Longview, Tex., to Phoenixville, Pa., with 20 in. branch lines to both New York City and to Philadelphia, Pa. Its delivery capacity averages 300,000 barrels of oil per day at the rate of 100 m. distance per day. Other Texas-East Coast pipe lines have been projected and some completed; among the latter is the 20 in. products line (also called the "Little Big Inch") from Baytown (Houston), Tex., to Linden, N.J. (Mar. 1944). Throughout most of its 1,475 m. route this pipe line runs parallel to the "Big Inch."

Pipes of this kind are made of iron, commonly in 18 ft. lengths. Most of them are welded, but in some cases a dresser coupling is used. The sections are usually laid 2 ft. below the surface and the oil or gas is pumped through the lines. Where they cross hills and mountains, as is frequently the case, pumps of the high pressure, condensed compound type are required.

Pipefish (*pip'fish*), the name of a genus of fishes common to the warmer seas, but sometimes entering the adjacent fresh waters. These animals are peculiar for their tubular snout and long, slender body, which is covered with closely fitted bony plates. Adults attain a length of 3 ft., but the body is very thin and slender. About 150 species have been described, including several that are only a few inches in length. These animals are related to the sea horse, which they resemble in that the male has a brood pouch on the ventral side of the tail. In this pouch the young are carried for some time after they have been hatched, and return to it during danger even when they are of considerable size. Some of the

species spend much of their time with the head downward in the water, stirring the sand with their snout, which they do most frequently among the blades of eelgrass. See *Hippocampus*.

Pipit (*pip'it*), or **TITLARK**, a group of birds classed with the perchers. In many respects they resemble the lark. Many species have been described and some are widely distributed. The two species common to North America are the prairie lark and the American titlark, both of which sing while pursuing a circuitous flight through the air. The best known species of Europe are the rock, sea, and field pipits, but closely allied birds are common to many parts of Asia and Africa. They nest on the ground and are easily distinguished by their simple and clear song.

Pippin (*pip'in*), **HORACE**, Negro painter, born Feb. 22, 1888, in West Chester, Pa., died July 6, 1946. He did not paint until 1931, at which time he began to work under the double handicap of never having had any instruction and of having sustained an injury to his right shoulder during World War I, so that he was forced to support his right arm with his left while he painted. He did not finish his first painting, "The End of the War—Starting Home" until 1934, but by 1937 he had progressed enough to have a one-man show in West Chester. In the following year, the Museum of Modern Art exhibited some of his work and thereafter his paintings were shown frequently in galleries and museums until his death. Pippin had an unsophisticated approach, a solid primitivity, and his scenes, mostly depicting Negroes, were painted in bright colors and in always interesting compositional arrangements.

Piqua (*pik'wā*), a city in Miami County, Ohio, on the Miami River, 87 m. N. of Cincinnati. It is on several surfaced highways, on the Pennsylvania and the Baltimore & Ohio R.R.'s, and on the Miami & Erie Canal. The principal buildings include the city hall, the Schmidlapp Library, and many churches. Among the manufactures are flour, underwear, corrugated iron, hardware, furniture, woolen goods, and linseed oil. The surrounding country is devoted to agriculture, particularly to dairy farming. Population, 1940, 16,049; in 1950, 17,447.

Piquet (*pē-kēt'*), a game of cards for two players, using a pack of 32 (the regular pack of 52 with the 2's to 6's inclusive deleted). Each player receives 12 cards. The first player must discard 1 to 5 cards and draw replacements from the 8 cards left after the deal. The second player may draw any or all of the cards not taken by his opponent.

Points are scored by having the best long suit, the highest four-of-a-kind, the highest or longest sequence in suit, or *carte blanche* (no face

card); by winning tricks; by taking the majority or all of the tricks. There are bonuses (*pic* and *repic*) for scoring 30 in a deal before the opponent scores at all. The game is 100 points, whence the name *le cent*, anglicized in Shakespeare and elsewhere as Sant, Saunt, or Saint. The name Piquet is found rendered as Picket or Pickett. The game was ancient in 1535, when Rabelais listed it among the games known to Gargantua. Legend ascribes the origin of piquet to the period of Charles VI of France (1380-1422).

Piracy (*pī'ra-sy*), robbery committed on the high seas, similar to brigandage on land. Since piracy is considered a crime against mankind, it may be punished by international law in a competent court of any nation. All nations give to individuals the right to pursue and to capture pirates. There is, however, a stipulation against killing pirates without a trial, conducted by a properly constituted tribunal. The pirate is distinguished from the privateer (*q.v.*) in that the pirate does not hold a commission from any nation. Indeed, he raids the ships of all nations. Occasionally, acts of privateers have been characterized by piracy. For example, the sinking of merchant ships by German submarines during World War I was described by many as piracy, even though the acts were carried out under the authority of a national state. As a result, the Washington Treaties (1921-22) held that any illegal visit and search of merchant ships by an individual in the service of any nation constituted piracy.

Piracy has flourished during periods of war and unrest, when navies have been deployed from their usual task of patrolling the commercial sea routes. Pirates typically have based their activities along popular trade routes, preferably on an archipelago, which provides an excellent lookout and defense station. Accounts of piracy and of daring deeds of highway robbery on the high seas have come down to us in legends, folktales, and histories from ancient times.

The Phoenician colonists regarded piracy as an honorable occupation and made it a prolific source of profit. This was likewise the view taken by the early Grecians and Romans. Great bands of pirates had their seat for centuries in various regions bordering on the Mediterranean. Pompey was given command of a large military and naval force by the Roman government for the purpose of subduing the pirates who infested the sections adjacent to Rome. The Northmen, however, were the most noted pirates of Europe; they commanded the northwestern coasts from the 7th to the 11th centuries. It was partly for protection against the sea rovers that the Hanseatic League was formed by European cities.

During the 17th and 18th centuries, the un-

charted islands and bays of the West Indies harbored an infamous association of pirates known as the buccaneers. Led by such notorious outlaws as Sir Henry Morgan and Edward Teach, sometimes called *Blackbeard*, the buccaneers plundered the Spanish colonies in the Caribbean and along the coasts of South America, and preyed upon Spanish trading vessels. The buccaneers found markets for much of their stolen goods in the American colonies.

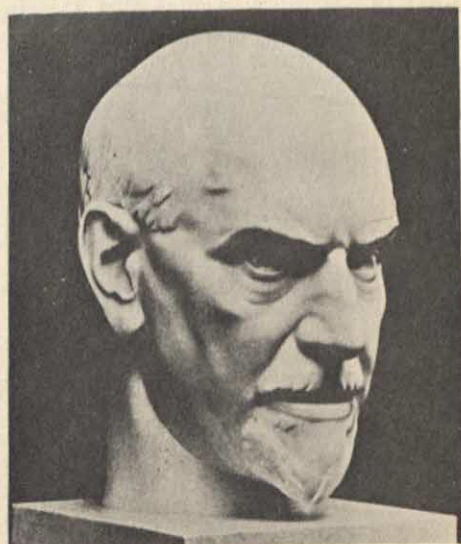
The rise of national navies led to the decline of piracy. The West Indian pirates were finally subdued ca. 1816, as were the *Barbary corsairs*, who destroyed the ports of Algiers, Tunis, and Tripoli.

Piraeus (*pī-rē'ūs*), a chief seaport of Greece, situated 5 m. s.w. of Athens. The site is on a peninsula of the same name and on the shore of a harbor formed by the Saronic Gulf. Phalerum was originally the port of Athens, but as early as 493 B.C. Themistocles recognized the advantages of Piraeus and began to fortify it. The city proper was probably laid out about a half century later by the architect Hippodamus of Miletus. The Romans under Sulla destroyed the city in 86 B.C., and during the long possession by Turkey Piraeus was a mass of ruins. Modern Piraeus, dating from the early 1830's, developed extensive manufactures and an important foreign trade and is today the third largest city of Greece. It is connected with Athens by a railway and a paved highway. The city was heavily damaged by German air raids in 1941 but has since been rebuilt. Population, 1951, 184,980.

Pirandello (*pē-rān-dēl'lo*), LUIGI, playwright

LUIGI PIRANDELLO

Bust by Werther Sever (1900-40)



and novelist, born in Sicily, Italy, June 28, 1867; died Dec. 10, 1936. He began to write poetry at the age of 16. He studied philology at the Univ. of Bonn, Germany, where he received his Ph.D. in 1891. Living near Rome, he published his first collection of short stories, "*Amori Senza Amore*" ("Love Without Love"), in 1893, and here, as well as in the novels which followed soon after, he displayed his deep interest in his native Sicily. Later, chiefly because of his own domestic problems, he became interested in the psychological, and adopted a tendency to look upon the darker side of life. His fame became great outside Italy, but it was not until after World War I that his native land finally gave him recognition. By that time, he had written not only his best novels, "The Late Mattia Pascal" and "The Old and the Young," but also his first play, "Right You Are if You Think You Are," which achieved great European success immediately after its premiere in 1916. He followed this with such interesting plays as "Henry V," "Six Characters in Search of an Author," "As You Desire Me," and "Tonight We Improvise." In his plays, Pirandello combined an acid humor with philosophical contemplation about reality and imagination, and a strongly introspective attitude. In 1934 he received the Nobel Prize for literature with the consent of Mussolini, who had refused to permit the philosopher, Benedetto Croce, to receive this high award.

Pisa (*pě'sa*), a city of Italy, capital of a province of the same name, on the Arno River, 44 m. w. of Florence, well connected with it and with other cities by an extensive railway system.

Pisa was founded by the Etruscans, but later became a part of Rome. Roman occupation dates from the 2nd century B.C., but it retained its own municipal government for many years. Reminiscent of this period of antiquity are the so-called "Bagni di Nerone," a few remnants from the *thermae* of the Imperial era. In the 11th century it was organized as a republic. It developed, in strongest competition with Genoa and Venice, into one of the foremost seaports and commercial centers in the Mediterranean area. The German emperors governed it after the fall of the republic. At this time it had 150,000 inhabitants, but it gradually fell into decay. The decline was due to the extended contentions between the Guelphs and the Ghibellines, and at one time its inhabitants numbered less than 10,000. It was made a part of the kingdom of Italy, along with the remainder of Tuscany, in 1860. Once a city of great wealth and renown, it still contains a number of evidences of its former prosperity.

Among the most noteworthy buildings is the cathedral, dating from the 11th century, enlarged in the 12th century into a five-nave basilica with an interior length of more than 310 ft. and a

breadth of 252 ft. The intersection of nave and transept is crowned by a great cupola. The interior is rich in fine sculptures, tombs, paintings, etc. One side of the transept is decorated by the famous bronze doors with reliefs by Giovanni da Bologna. Close to the cathedral is the baptistery with the well-known hexagonal sculptured pulpit of Niccolò Pisano (1260). Also nearby is the famous "Leaning Tower," built from the 12th to the 14th centuries, with a total height of 179 ft., deviating from the perpendicular by more than 16 ft. The three above-mentioned buildings form a great architectural unit, all characterized by the same outside pattern: white marble with horizontal greenish-black stripes. The Campo Santo, a famous cemetery, encloses the space surrounding the cathedral toward the north. Closed toward the outside, it is a cloisterlike quadrangular courtyard of a typically Tuscan Gothic style. One of its great art treasures was the famous fresco, "Triumph of Death," unfortunately completely destroyed during World War II. It was the work of an anonymous 14th-century painter, conveying social significance in a modern sense through its realistic interpretation.

Besides these four main attractions of old Pisa, the 15th-century university with its precious library, as well as its museum, and many churches, are noteworthy. Population, *ca.* 70,000. See also *Italy*.

Pisanello (*pě-zū-ně'l'lo*) (ANTONIO DI PUCCIO PISANO), Italian painter of the Veronese school, born *ca.* 1395, at Pisa, Italy; died *ca.* 1455, probably in Rome. He worked mostly in northern Italy. His style clearly shows its derivation from that of Gentile de Fabriano, but the miniaturelike delicacy of his panels suggests the tender, but nonetheless colorful, works of the late medieval school of Burgundy and Brabant. He was also an excellent draftsman and many drawings show, even better than his paintings, his observant love for nature, flowers, and animals. Unfortunately, few paintings of Pisanello's have survived.

Pisano (*pě-zā'nō*), NICCOLÒ, sculptor, born *ca.* 1206 at Lucca, Italy; died *ca.* 1278. First of the great pre-Renaissance artists, he was reputedly an architect as well as a sculptor. The most famous of his works are the pulpit of the baptistery at Pisa, with its remarkable bas-reliefs of Christ's life (1260), the octagonal pulpit in Siena Cathedral (1268), and his Arch of St. Dominic in the Cathedral of St. Dominic at Bologna (1267). He also executed sculpture on the fountains of Perugia.

Pisces (*pīs'ēz*), the 12th sign of the zodiac, which is entered by the sun on Feb. 20. Formerly it corresponded to the constellation of Pisces (the fishes), but the constellation is now mostly in the sign Aries, owing to the precession of the equinoxes. It contains no prominent stars, but includes

a number of interesting double stars. See *Zodiac*.

Pisces, in zoology, a class of animals having vertebrae, including all fishes.

Pisciculture (*pîs'î-kûl-châr*). See *Fish Culture*.

Pisidia (*pî-sîd'î-â*), an ancient country of Asia Minor, which occupied a region north of Pamphylia. The northern boundary was formed by Phrygia. The surface of this region is mountainous, including the loftiest ranges of the Taurus Mts. It is drained by the Cestus and Eurymedon Rivers, and contains a fresh-water lake about 30 m. long. The lake and rivers are noted for their fisheries. The inhabitants were long noted for their mountaineers, who resisted with great energy the encroachments and incursions of foreigners. Xenophon mentions the Pisidians in his "Anabasis," and subsequently they were referred to by the leading Greek historians. Alexander the Great came in contact with them when conquering Western Asia, but the Romans completely crushed their power and made them a part of the imperial territory. Their most noted cities included Antioch, Termessus, Selge, and Sagalassus. The sites of these cities have yielded many remarkable relics.

Pisistratus (*pî-sîs'trâ-tûs*), tyrant of Athens, born about 612 B.C.; died about 527 B.C. He was the son of Hippocrates and in his early political life supported the policy of Solon. Later he became allied with one of the three parties of Attica, becoming its recognized head, his wealth and scholarly eloquence making him one of the most influential leaders of his time. It is claimed that, after a violent dispute with Megacles in the public assembly, he came to the market place with self-inflicted wounds, which he pretended were received from political opponents. The people became indignant at the apparent ill treatment and placed a guard for his protection. This guard was skillfully increased until he was able to control the city and in 560 B.C. Megacles fled, but Solon remained at Athens and continued to oppose the dictatorial policy of Pisistratus.

Although termed a tyrant, he was by no means oppressive, but enforced the laws of Solon and provided for the material welfare of the city. After six years he was compelled to surrender his authority, but he succeeded in making himself master of the city a second time by the aid of Thebes and Argos. After five years he was again driven from Athens only to return after a short time. The rule of Pisistratus is noted for the erection of many public buildings and the establishment of libraries. He made ample provisions for the employment and support of the poor. He is credited with the collection of the poems of Homer, though the earlier authorities do not make mention of this. His country enjoyed greater prosperity and longer peace during his reign than in a majority of the administrations. In the

latter part of his reign he conquered Naxos. His sons succeeded him.

Pissarro (*pê-sâ-rô'*), CAMILLE, painter, born at St. Thomas in the Antilles, in 1830; died in 1903. Because of his later residence in France and the style of his work he is definitely a French artist. Notably a landscape painter, he was at first influenced by the famous Barbizon school of painters, such as Millet and Corot. Later, however, his preoccupation with the effects of light on objects and with the impressions subtly received through atmosphere and color of a scene led him to align himself with the then modern Impressionistic school, including Renoir, Monet, Degas, etc. For a short time, around 1875, he followed the technique of the Pointillists—those artists who dissolved the surface into individual dots (points), led by Georges Seurat (*q.v.*), but soon came back to a broader style of painting although vibrant and diffuse in catching the light. Pissarro canvases hang in all the principal galleries of Europe and America.

Pistachio (*pîs-tâ'shî-ô*), or PISTACIA, a tree about 20 ft. in height, indigenous to Syria and Persia, and cultivated in the south of Europe and North Africa. Its nuts are widely used for culinary purposes, as is the oil which is a product of the nut.

Pistol (*pîs't'l*). See *Revolver*.

Pitcairn (*pî't'kârn*), JOHN, soldier, born in Fifeshire, Scotland, in 1740; died in 1775. He entered the military service and was rapidly promoted, being made a captain in 1765 and a major in 1771. For some time he was stationed at Boston under Gen. Gage, who sent him to Concord in 1775 to destroy the military stores. However, he was confronted by minutemen at Lexington, who refused to disperse at the order of the British, when the soldiers fired and killed seven Americans. There has been an extended dispute as to which fired the first shot, though Major Pitcairn maintained that the soldiers were first fired upon by the colonists. On June 17, 1775, in the Battle of Bunker Hill, he was mortally wounded.

Pitcairn Island, an island of the South Pacific Ocean, situated between Australia and South America, in the southeastern part of the Polynesian Archipelago. It is about 1 m. wide and $2\frac{1}{4}$ m. long. The surface is fertile, though the coasts are high and rocky, and there is an abundance of timber. This island, first visited by Carteret in 1667, is of itself unimportant, but it is celebrated on account of its becoming the dwelling place of a number of mutineers. In 1789 the British ship *Bounty* was sent from India to the West Indies, but when it reached Tahiti, one of the Caroline Islands, where a supply of breadfruit trees was to be gathered, the season for taking them had not arrived. For two months the crew was idle and during this time became demoralized

and soon after mutinied. The captain and those who would not join them were put off in a boat and set adrift on the ocean. After 46 days they reached inhabited land. However, the mutineers returned to Tahiti and nine of these with a number of native men and women sailed from Tahiti in 1790 and formed a settlement on Pitcairn Island, which was then uninhabited.

An Englishman named Alexander Smith changed his name to John Adams, and became recognized as the leader of the little colony. Several of the Tahitians were murdered as the result of quarrels, but the others remained on the island. It was thought that the *Bounty* and its occupants had been lost at sea until, in 1808, Capt. Folger with the American ship *Topaz* discovered them, but Adams was the only one of the mutineers who was then alive. However, there were a large number of fine farms and houses on the island, and the descendants of the mutineers had advanced remarkably in educational and industrial arts. A British vessel visited the island in 1831, when the inhabitants numbered 87, and in the same year transferred them to Tahiti, but they returned to Pitcairn within a year. In 1856 they numbered 194, and it was found that the island was too small to support that number. They were accordingly removed to Norfolk Island, but about 40 soon returned. A British colony under the jurisdiction of the High Commissioner for the Western Pacific, it has a population of about 140.

It has attracted the attention of various writers, notably Mark Twain in "Following the Equator," Nordhoff and Hall in "Mutiny on the *Bounty*," and Amasa Delano in "Voyages and Travels."

Pitch (*pich*), a product obtained by boiling tar until the volatile naphtha is driven off. It may be obtained from wood and coal tar, stearine residue, bone tar, and petroleum. Pitch has a dark color and brilliant luster and is a solid at ordinary temperatures. It is used extensively for closing up seams in shipbuilding, for keeping wood from decay and iron from rusting when exposed to the weather, and for making artificial asphalt. A grade produced in Finland is called *Burgundy pitch* and has medical properties. The term *mineral pitch* is sometimes applied to asphalt.

Pitchblende (*pich'blënd*), a mineral, source of uranium and radium. See *Uranium*. See also color plate, *Minerals and Strategic Ores*, in Volume IX.

Pitcher (*pich'ēr*), MOLLY (MARY LUDWIG HAYS MCCAULEY), American Revolutionary heroine, born near Trenton, N.J., Oct. 13, 1754; died in Carlisle, Pa., Jan. 22, 1832. She accompanied her first husband, John Hays, to the battle of Monmouth (June 28, 1778) and won the nickname of Molly Pitcher for her willingness in bringing water to the thirsty and wounded. When her

husband was overcome by the heat of the day, she continued to fire his cannon throughout the battle. Hays died in 1789, and she later married George McCauley. The Pennsylvania Assembly granted her an annuity for her valor in 1822.

Pitcher Plants (*plānts*), a group of plants which have their leaves or petioles formed like pitchers, in which more or less fluid is stored. Botanists classify them into two general divisions, known as the American and East Indian pitcher plant families. The American pitcher plants (genus *Sarracenia*) include five or six species, found mostly in the eastern part of the U.S., California, and Canada. The East Indian pitcher plants (genus *Nepenthes*) include a large number of species and are found widely distributed in Australia, the East Indies, and southern Asia. They are inclined to be shrubby and often climbing. They grow best in low or swampy regions. Each leaf is prolonged and forms a cuplike vessel resembling a pitcher, and over the top extends a lid that may be regarded the true leaf blade. The plant secretes the fluid. This fluid attracts insects, such as flies and beetles, and they are often found drowned in it. Darwin classed these plants among the insectivorous, for the reason that the drowned insects are dissolved and absorbed by the plants as nutritious matter. Pitcher plants are cultivated to some extent as a curiosity.

Pith (*pith*), the cylinder of soft, spongy tissue in the center of the stems or branches of exogenous plants. The stems of young plants are composed entirely of pith and bark, but later the woody fiber develops, and the pith is reduced until it forms only a small part of the stem. Pith is composed of cellular tissue, which in young plants contains starch. Later the pith may disappear, leaving a hollow space.

Pithecanthropus Erectus (*pith-ē-kān-thrō'pūs ē-rēk'tūs*) or JAVA MAN, one of the oldest known forms of primitive man, believed to have lived almost 500,000 years ago. A skull of the species was found in 1891-92 by Eugène Dubois of Holland, in the dry bed of the Solo River in central Java. From 1936 to 1941 several more skulls were found in the same area. Java man had a profile like an ape's, with a very low forehead and undeveloped chin. His brain had a capacity of 900 to 1,000 cu. cm., larger than any known ape's but smaller than any normal modern man's. See *Peking Man*; *Prehistory*.

Pitman (*pit'man*), BENN, artist and stenographer, born in Trowbridge, England, July 24, 1822; died in Cincinnati, Ohio, Dec. 28, 1910. A brother of Sir Isaac Pitman (*q.v.*), inventor of the Pitman shorthand system, he came to the U.S. in 1853, settling in Cincinnati, and became interested in the publication of textbooks on shorthand. From 1862 to 1865 he served as official reporter for the government. He became con-



DEATH OF WILLIAM PITT, EARL OF CHATHAM

nected with the Cincinnati School of Design as a teacher of descriptive art in 1873, originated what became known as the Pitman School of Wood Carving, and produced many wood carvings and naturalistic designs in wood sculpture. He published "History of Shorthand" and "Life of Sir Isaac Pitman."

Pitman, SIR ISAAC, educator and inventor of the Pitman system of shorthand writing, born in Trowbridge, England, Jan. 4, 1813; died Jan. 22, 1897. He obtained his education at the Normal Coll. under the direction of the British Foreign School Society. In 1832 he became a teacher at Barton-on-Humber, and subsequently taught at Wotton-under-Edge. In 1839 he removed to Bath, where he organized the Phonetic Society, and later established a printing office to publish the textbooks on shorthand used in his work. He established the *Phonetic Journal*, a periodical devoted to reforms in writing and spelling, and published a large number of manuals and textbooks on the Pitman system of shorthand which is used by many reporters. It has been adapted for use in many languages. Queen Victoria knighted him in 1894. His most important publications include "Writing by Sound" and "Phonographic Reporter's Companion." See also *Shorthand*.

Pitt (*pī*'), WILLIAM, Earl of Chatham, orator and statesman, born in Westminster, England, Nov. 15, 1708; died May 11, 1778. He was the son of Robert Pitt, a country gentleman, studied at Eton and Oxford, and after being graduated made an extensive tour of Europe. In 1735 he was elected to Parliament, where he supported Frederick, Prince of Wales, in opposition to the king and Walpole (*q.v.*), the latter being minister at that time, and helped to bring about Walpole's defeat in 1742. His aggressive attitude induced the government to deprive him of his office in 1775, when he attacked the government, but his ability and eloquence caused his influence in public affairs to increase steadily. In 1756-57, as secretary of state and leader of the House of Commons,

he was virtually prime minister. Dismissed in 1757, the year after the beginning of the Seven Years' War, for his opposition to the king's foreign policy, he was immediately recalled, and during the four years of his ministry Great Britain attained many of its greatest achievements. The forces of France were defeated everywhere—on the Rhine, in India, in Canada, and in Africa.

Pitt was the director of all the great movements of the military and naval forces, and to him may be attributed in a large measure the winning of both India and Canada. He opposed the tax act proposed by Parliament, on the ground that taxation should not be imposed upon any colony without representation, but later he modified his view and vigorously opposed those wishing to grant independence to the colonies. At the accession of George III he resigned his office, but continued to exercise much influence in the government, both domestic and foreign. Pitt was one of the most aggressive English statesmen opposing American independence, and, when a treaty was made between the American colonies and France, he looked upon proposals of peace as overtures to prostrate Britain before the Bourbons of France. His last noted speech before the House of Lords was in opposition to making peace with the colonies and the acknowledgment of the independence of the U.S. Four days later he died at Hayes. He was buried in Westminster Abbey, where a statue commemorates him. In 1766 he was made Viscount Pitt and Earl of Chatham. Greatly admired by the British people, he was popularly known as the "Great Commoner."

Pitt, WILLIAM, called "the Younger Pitt," statesman, born at Hayes, Kent, England, May 28, 1759; died in London, Jan. 23, 1806. The second son of William Pitt (*q.v.*), Earl of Chatham, he received his early education at home, showing an unusual capacity for mathematics and ancient languages. He took his formal education at Cambridge and was admitted to the bar in 1780. In the same year, after a tour of the Continent, he stood as candidate for Parliament from the

Much of the stimulus to the development of modern philosophy has come from the rise of the physical sciences in the 15th and 16th centuries, because of the apparent incongruity between their conclusions and those of tradition and common sense. In consequence, modern philosophers have been intensely preoccupied with the nature of knowledge and the grounds of intellectual certitude. One influential school, often designated as *Rationalism* and made to include such diverse philosophies as those of *Descartes*, *Benedict Spinoza* (1632-77), and *Leibnitz* (1646-1716), maintained that man's reason is capable of achieving indubitable truth about existence, but without the support of experiment and sensory observation. Another influential school of thought, designated as *Empiricism* and including such representative thinkers as *John Locke* (1632-1714), *David Hume* (1711-76), and *John Stuart Mill* (1806-73), claimed that, on the contrary, reason alone could establish no necessary truths about matters of fact; and various attempts were made to show that all knowledge is derived from experience, and grounded upon the facts of sensory observation. A third school, initiated by *Immanuel Kant* (1724-1804) and called *Critical Idealism*, maintained that the absolutely universal and necessary truths we do possess are simply the expression of the mind's legislative activity to which all intelligible experience must conform. A good deal of contemporary philosophy is a variant upon one or more of these different conceptions concerning the nature and sources of knowledge.

The period following Kant is distinguished by a large variety of ambitious philosophic systems which cannot be conveniently brought under any simple scheme of classification. In the main, 19th-century philosophy was an attempt to adjust the conflicting claims of the natural and social sciences, and to reconcile the findings of the former with the facts of moral and religious experience. Concern with the functions and history of various social institutions looms large in *Hegel's* system of *Absolute Idealism*. In it he tried to demonstrate the inherent rational character of reality, and to show that human societies develop in the direction of progressively more integrated and complete social structures; and similar views are found expressed in the writings of the English Hegelians *Thomas Hill Green* and *Bernard Bosanquet*, as well as by the Italian thinker *Benedetto Croce*. The idea of necessary progress through evolution was given a wide publicity by *Herbert Spencer*, whose philosophy was influenced not only by Darwin's theory of organic evolution, but also by the post-Kantian version of Neo-Platonism developed by the German *Friedrich Schelling*. The central ideas of Kant were employed by *Arthur Schopenhauer* in con-

structing a fundamentally pessimistic conception of the basic nature of things. *Friedrich Nietzsche*, in turn building on Schopenhauer, used certain features of the latter's philosophy to affirm the joys of life and heroic effort.

The present century has to its credit a number of important and influential philosophical movements. Among them are *Pragmatism* (*q.v.*), developed largely by the Americans *William James* and *John Dewey*, according to which ideas are instruments or plans for action, to be tested by their adequacy in solving the concrete problems of men. The Frenchman *Henri Bergson* won a large international following for his doctrine that the intellect is primarily a practical organ which cannot faithfully grasp the intimate character of real change or process, a task for which a peculiar faculty of intuition is alone competent. In Germany a highly technical system of thought known as *Phenomenology* (*q.v.*) was originated by *Edmund Husserl*, and later developed by *Martin Heidegger* and others into *Existenz-philosophie* or *Existentialism*; the latter is concerned largely with the analysis of human consciousness and the historical conditions of human existence. Finally, influenced by developments in modern theoretical science and in mathematical logic, a number of thinkers (including *G.E. Moore*, *Bertrand Russell*, and *Rudolf Carnap*) have vigorously urged the use of the precise tools of logic in philosophy, and have attempted to solve outstanding philosophical issues by piecemeal attack rather than by large-scale but vague intellectual constructions.

THE DIVISIONS OF PHILOSOPHY. It is customary to distinguish between the major types of inquiries conducted by philosophies and to divide their broad field of study into branches. The usual divisions are as follows: *Metaphysics*, the inquiry into the generic or pervasive traits of all existence; *Epistemology*, the study of the sources, limits, methods, and validity of knowledge; *Logic*, the inquiry into the criteria of correct thinking; *Ethics*, the study of the nature of moral values, and of the sources of human obligations; *Esthetics*, the inquiry into the nature of the beautiful, and into the norms of esthetic perfection; *History of Philosophy*, the critical examination of systems of philosophy, and the study of the causes and consequences of philosophical activity.

The literature of philosophy is almost literally endless. The most satisfactory way to become familiar with its problems and methods is to read the writings of the outstanding figures in its history. The reader could do much worse than to begin with the *Dialogues* of Plato and then continue in whatever direction interests him. The aids provided by histories of philosophy are often useful and are not to be spurned, though there is no completely satisfactory work in English which

covers the entire period from ancient to modern times. *Harald Höffding's* "History of Modern Philosophy" is excellent reading for the modern period, and *B.A.G. Fuller's* "History of Philosophy" supplies an easy introduction to the major figures of philosophy in ancient, medieval, as well as modern times.

Phimosis (*fī-mō'sīs*), in medicine, a condition in which the foreskin becomes inflamed and adherent to the underlying structure, with accompanying discomfort and difficulty of urination. The condition can be corrected by circumcision (*q.v.*).

Phlebitis (*flē-bī'tīs*), inflammation of a vein, usually suppurative (pus forming), due to extension of suppurative inflammation from surrounding or adjacent tissues. It usually leads to the formation of a thrombus (blood clot) in the vein (thrombophlebitis), which may occasionally break off in pieces called emboli which may become lodged in other parts of the body, transported by the blood stream, and may even be fatal if lodged in certain vital spots such as heart, lungs, or brain. Phlebitis when not due to a suppurative process is called adhesive, plastic, or proliferative, and may result in complete obliteration of the vein. The symptoms of phlebitis are pain and swelling of the affected part, usually a leg or an arm, with redness and exquisite tenderness along the course of the involved vein, which may appear hard and cordlike. Treatment should always be carried out in a hospital and includes rest in bed with the affected part elevated, compression bandages, heat applications, anti-bacterial drugs such as penicillin, local anesthesia to relieve pain and blood-vessel spasm, and occasionally surgical intervention. Heparin (*q.v.*) and dicumarin are also widely used now to prevent dangerous thrombus formation in phlebitis of large veins.

Phlox (*flōks*), a genus of plants with opposite leaves and beautiful flowers. The numerous species are mostly herbaceous, but some are shrubby plants. Nearly all are tall, erect, and perennial. The flowers appear in clusters at the upper end of a stalk and are white, blue, purple, lilac, or crimson. Most of the species are native to North America, the only exceptions being a few that are found in Asia. Among the familiar species are the *creeping pink* of the South and the *sweet William* found in the central part of North America. The latter blooms in the spring and early summer and has bluish or lilac colored flowers. *Drummonds phlox* is a favorite species and is cultivated extensively. It is an annual and blooms profusely until frost comes.

Phobia (*fō'bi-ā*), in psychiatry. See *Psychiatry*.

Phocion (*fō'shī-ŭn*), Athenian general, born about 402 B.C. He was descended from humble parentage, studied under Plato and Diogenes, and

attracted public attention for the first time in 376 B.C., when he aided the Athenian fleet in securing a victory at Naxos. Later he defeated the forces of Philip of Macedon in Euboea. In 340 B.C. he compelled Philip to raise the siege of Byzantium and afterward to evacuate several adjacent strongholds. When Demosthenes delivered his celebrated *Philippics*, Phocion resisted that statesman, for the reason that he desired peace rather than war. He also advised a peaceful policy at the time the Athenians advocated the war with Antipater, and later was compelled to drink hemlock for being charged with intrigues to deliver positions of trust into the hands of the enemy. However, these charges were afterward found to be groundless and many monuments were raised to his honor. His life was written by Plutarch, who asserts that he was elected 45 times as commander without seeking the office and that he lived on a small farm, on which he cultivated cereals and fruits.

Phoebe (*fē'bē*), or **PEWEE**, a small bird of the flycatcher family, found in many parts of North America. It frequents gardens and orchards and is called *pewee* from its call. The head is brown and the general color is olive-green. It constructs a nest of mud and moss, which is attached to rocks and cliffs, or frequently to the eaves of houses and the piers of bridges. The eggs are white and usually two broods are reared in a season. In autumn these birds move southward to spend the winter.

Phoebus (*fē'būs*), an epithet commonly applied by the Greeks to Apollo, which had special reference to the youthful beauty and purity of that deity. In like manner they frequently applied the name Phoebe to Artemis, the moon god. The Roman poets and many modern writers apply the names *Phoebus* and *Phoebe* to the sun and moon respectively.

Phoenicia (*fē-nīsh'ī-ā*), a country of ancient times, situated on the eastern coast of the Mediterranean Sea. It stretched along the coast a distance of about 125 m., beginning in the south a little below the Carmel promontory and extending north to the Island of Aradus. The average breadth was about 20 m.

DESCRIPTION. The soil in the valleys is generally of alluvial origin, being formed largely from the deposits of streams descending from the mountains along the eastern boundary, while adjacent to the sea are extensive sand dunes. Two plains characterize the surface, one at Eleutherus in the north and another inland from Acre, but the mountains trend to within a few miles of the coast at several intermediate points. The narrow coast plain is noted not only for its fertility, but for having been a favorite route for caravans from remote antiquity. Few indentations characterize the coast, but in former



WILLIAM PITT

university but was defeated. He entered Parliament in January 1781, however, and made his first speech on Feb. 26, in support of the economic reforms proposed by Edmund Burke. His subsequent rise in government was rapid. He became chancellor of the exchequer in 1782, under the earl of Shelburne, and was offered the position of prime minister by King George III in the following year. Pitt declined the offer but accepted the premiership a short time later following the dissolution of the Fox-North government, which had been under the nominal leadership of the duke of Portland.

Pitt established a strong government and was especially noted for his astute handling of the treasury, although a monetary crisis was precipitated by his support of England's allies against France. He was originally a liberal Tory but was led by the revolutionary events in Europe to institute repressive measures in England. He resigned the ministry in 1801 because of the king's opposition to concessions to Irish Catholics, but he was reappointed in 1804. Pitt made strenuous efforts to stem the growing power of Napoleon and was thrown into profound grief, which undoubtedly hastened his death, when Napoleon won the battle of Austerlitz (*q.v.*). He was buried in Westminster Abbey beside his father.

Some of the most notable events in the history of England occurred during Pitt's ministry. Among them were the passage of the regency bill in 1788, the French Revolution, the war with France in 1793, and the union with Ireland in 1800. He was a brilliant orator and did much to improve the parliamentary system and the trade, credit, and financial position of his country.

Pitti Palace (*pit' tē pāl'is*), an impressive early Italian Renaissance structure in Florence, on the

PITTSBURGH

left bank of the Arno River, begun about 1458 by Luca Fancelli (after plans by Brunelleschi, prepared in 1440), and named for Luca Pitti, a Florentine nobleman. In 1549 Duke Cosimo de' Medici acquired the palace and made it a royal residence. After many additions and changes, the palace had assumed its present appearance by 1852. It contains the Galleria Pitti, or Palatina, a collection of more than 500 paintings, representing the 15th through the 17th centuries.

Pittsburg (*pīts' bûrg*), a city in western California, 40 m. e. of San Francisco, on the San Joaquin and Sacramento rivers. It is on the Southern Pacific, the Santa Fe, and the Sacramento Northern R.R.'s. Manufactures include rolled steel and wire, chemicals, brick, roofing material, rubber goods, and lumber and millwork. Fish packing and shipping and ship repairing are important industries. Formerly known as the "New York of the Pacific," the city was settled in 1855, incorporated in 1903, and received its present name in 1910.

Population, 1950, 12,763; in 1960, 19,062.

Pittsburg, a city in southeastern Kansas, in Crawford County, 130 m. s. of Kansas City, on the Kansas City Southern, Missouri Pacific, and Atchison, Topeka and Santa Fe R.R.'s. The surrounding county has deposits of coal and clay and engages in stock raising, dairying, and poultry and mixed farming. Among the manufactures are coal-processing equipment, railroad cars, clay pipe, chemicals, brick, pottery, and clothing. The city's value added by manufacture in 1958 was \$8,465,000. Pittsburg is the site of Kansas State Teachers Coll. It was first settled in 1872, as a mining town, and incorporated in 1880.

Population, 1940, 17,571; in 1950, 19,341; in 1960, 18,678.

Pittsburgh (*pīts' bûrg*), a city and port of entry in southwestern Pennsylvania, seat of Allegheny County, second-largest city in the state, 16th-largest in the U.S., located *ca.* 250 m. w. of Philadelphia. The city is divided into three parts by two rivers, the Allegheny and the Monongahela, which merge at Pittsburgh to form the Ohio River. A narrow strip of land coming to a point where the two rivers meet provides a concentrated business section, known as the Golden Triangle. The area of the city is 54.1 sq. m.

In the Golden Triangle, new buildings facing Mellon Square—Pittsburgh's most prominent open area, with underground parking facilities for 1,000 cars—such as the 40-story 525 William Penn Place Building and the 30-story Alcoa Building, faced with aluminum, and the 16-story State Office Building in Gateway Center, rise amid the parks and widened streets. Important religious structures of the city include Trinity Cathedral (Protestant Episcopal) and St. Paul's Cathedral (Roman Catholic). A reminder of the city's early

life is preserved in the Ft. Pitt Block House in Point Park at the tip of the triangle. Beyond the business section are the Lower Hill redevelopment project and Oakland, the city's cultural center.

TRANSPORTATION: Pittsburgh is on a direct east-west line of rail travel and is served by 24 railroads, including the Baltimore & Ohio, the Pennsylvania, and the Pittsburgh & Lake Erie R.R.'s. The city's airport is located 15 m. from the center of downtown Pittsburgh. Traffic on the three rivers is heavy, transporting such commodities as coal, steel, and sand and gravel.

INDUSTRIES: The city is the industrial center of a vast bituminous (soft) coal region. Steel is the most important industry, with steel plants located along the rivers for a distance of 40 m. from the city. Other important manufactures include aluminum, first produced here in 1888, glass, electric products, iron, oil, and electric power, and food products. Pittsburgh is at the center of a standard metropolitan statistical area (3,051 sq. m.; pop., 1960, 2,405,435), comprising Allegheny, Beaver, Washington, and Westmoreland counties. The value added by manufacture of the area in 1958 was \$2,622,340,000; the city's value added by manufacture was \$619,470,000.

EDUCATION: The public-school system enrolls about 70,000 pupils annually; another 95,000 pupils are enrolled in parochial schools in the county, and an additional 85,000 are educated in county public schools. Institutions of higher learning include the Univ. of Pittsburgh (*q.v.*), the Carnegie Inst. of Technology, Duquesne Univ., and Mt. Mercy and Chatham colleges for women. Among Pittsburgh's scientific research centers, the Mellon Inst. (see *Mellon, Andrew William*) is the oldest and perhaps the best known. There are also numerous trade and business schools and a dramatic school at the Pittsburgh Playhouse. Cultural and recreational

resources include the Pittsburgh Symphony Orchestra, the Pittsburgh Opera, Inc., the Civic Light Opera, the Carnegie Central Library with over 1,000,000 books and a number of branch libraries, the Buhl Planetarium, a music hall, art gallery, conservatory, and museum, and a zoo and aviary. About 4 m. from downtown Pittsburgh is Forbes Field, where the Pittsburgh Pirates, the city's National League baseball team, play.

GOVERNMENT: The city's charter (1816) provides for a mayor-council form of government and, while it is not consolidated with Allegheny County government, the two work in close harmony and much of the work of the two separate units has been synchronized or unified. The mayor and council of nine members are elected every four years.

HISTORY: The history of the city began in the 1740's when English traders from Philadelphia and Baltimore traveled by packhorse to trade with the Indians for furs. In 1753 George Washington, on his first military mission, located the exact site of the future city as a place suitable for a frontier fort. Upon his recommendation, the English built a fort, only to have it seized by the French, who built Ft. Duquesne, occupying it until 1758 when the British again claimed the land and named the place Pittsburgh. It was laid out as a town in 1764 and incorporated as a city in 1816. Its location on three major rivers and the nearby coal fields early made Pittsburgh an important industrial center, which grew rapidly after it became linked with the East by railroads and began to produce steel. For many years, however, it was known as the "Smoky City," because of the large amount of smoke which always hung over it from the soft coal used as fuel by the residents. Since World War II Pittsburgh citizens and local government authorities have cooperated to rid the city's atmosphere of smoke and to redevelop

PITTSBURGH'S NEW GOLDEN TRIANGLE

Here, the Allegheny River (*left*) joins the Monongahela River (*right*) to form the Ohio River

Courtesy Samuel A. Musgrave





Courtesy Photo Associates, Pittsburgh, Pa.

ALCOA BUILDING, PITTSBURGH

A 30-story aluminum-sheathed skyscraper

depressed areas and beautify the city.

Pittsburgh's decade of greatest population growth was 1900-10, which saw an increase from 321,616 to 533,905, partly as the result of the annexation of Allegheny. In 1950 the population was 676,806; in 1960, 604,332.

Pittsburgh, UNIVERSITY OF, a coeducational, privately controlled, state-aided, nonsectarian institution, located in Pittsburgh, Pa. Chartered as Pittsburgh Acad. in 1787 and reincorporated as Western Univ. of Pennsylvania in 1819, the university received its present name in 1908. The institution consists of the College, with divisions of the humanities, social sciences, and natural sciences; the schools of engineering, mines, business administration, education, law, retailing, medicine, dentistry, pharmacy, and nursing; and the graduate schools of public health and of social work. The Univ. of Pittsburgh's present building is the first skyscraper university ever built (for illustration, see *Education*), and its Health Center comprises 24 hospitals and other medical facilities. The university libraries contain ca. 725,000 volumes. The faculty numbers about 2,000 and there are approximately 13,500 students.

Pittsburg Landing, BATTLE OF. See *Shiloh, Battle of*.

Pittsfield (pĭts'fĕld), a city in western Massachusetts, seat of Berkshire County, 120 m. w. of Boston, on the Housatonic River. It is on the New

York, New Haven and Hartford and the Boston & Albany R.R.'s. Principal manufactures include electrical equipment, textiles, and paper products. The city is at the center of a standard metropolitan statistical area (111 sq. m.; pop., 1960, 73,839) comprising, besides Pittsfield, the towns of Dalton, Lenox, and Lee. The value added by manufacture of the area in 1958 was \$144,352,000, of which the city accounted for \$123,268,000. Features include the homes of Oliver Wendell Holmes and Herman Melville (*qq.v.*) and a number of 18th-century churches. Settled as Pon-toosuc in 1752, the city was incorporated as Pittsfield in 1761. Population, 1950, 53,348; in 1960, 57,879.

Pittston (pĭts'tŭn), a city in eastern Pennsylvania, in Luzerne County, 8 m. s.w. of Scranton, on the Susquehanna River. It is served by the Lehigh Valley, Delaware and Hudson, and other railroads. Principal products include coal, building materials, lawn mowers, paper, and wearing apparel. Nearby is the Wyoming Monument, marking the scene of a massacre of colonial settlers by Indians in 1778. Pittston was settled in 1768 and was incorporated as a city in 1894. Population, 1950, 15,012; in 1960, 12,407. See also *West Pittston*.

Pituitary Gland (pĭ-tu'ī-tēr-ĭ glānd), a small, rounded, reddish-gray organ attached to the base of the brain. It consists of three distinct lobes, and the sum total of its secretions is of such importance to the proper functioning of the body that it has been called the master gland. Its anterior (front) lobe produces specific hormones which regulate bodily growth, the activity of the thyroid gland, the adrenals, and the glands concerned with reproduction. The secretions of the posterior (rear) lobe affect blood pressure, some functions of the kidneys, and the activity of certain muscles. The function of the intermediate lobe is still being studied. See also *Glands*.

Piura (pyōō'rā), a city in Peru, capital of Piura department (area, 15,239 sq. m.; pop., 519,763), on the Piura railroad, which connects it with Paita on the Pacific Ocean. It is in an agricultural region (principal crop, cotton, raised with the help of irrigation) and is a center for the shipment of livestock. Among its industries are the manufacture of Panama hats and the refining of oil derived from fields in the department. The town dates back to 1532, when Francisco Pizarro (*q.v.*) founded San Miguel de Piura. When the original location was found to be unhealthful, the town was moved to its present site. Population, ca. 25,000.

Pius (pĭ'ūs), the name of 12 popes, eight of whom are treated in special articles below. Little is known of PIUS I but that his pontificate was from ca. 140 to ca. 154. He resisted Gnosticism (*q.v.*) and was canonized. PIUS III (Francesco

Todeschini Piccolomini) was born in Siena, Italy, May 29, 1439, and died in Rome Oct. 18, 1503, just four weeks after he was elected pope. **PIUS VI** (Giovanni Angelico Braschi) was born in Cesena, Italy, Dec. 27, 1717; died in Valence, France, Aug. 29, 1799. He assumed the papacy on Feb. 15, 1775, and his reign was marked by disputes with Emperor Joseph II of Austria over ecclesiastical reforms. After the French Revolution, France annexed the Papal States in retaliation for the pope's protest against the execution of Louis XVI. Pius VI was taken prisoner in 1798, although seriously ill, and held in Valence, where he died. **PIUS VIII** (Francesco Xaverio Castiglione) was born in Cingoli, Italy, Nov. 20, 1761; died in Rome, Dec. 1, 1830. He became pope on March 31, 1829, and reigned for less than two years; he was succeeded by Gregory XVI in 1831. See also *Pope*.

Pius II (ENEA SILVIO DE' PICCOLOMINI), pope (1458-64), born in Corsignano, Oct. 18, 1405; died in Ancona, Aug. 14, 1464. Of noble birth, he received a liberal education and at 26 became secretary to the bishop of Fermo, whom he assisted (1431-35) at the Council of Basel. There he joined the opposition to Pope Eugene IV. For many years the young man led a frivolous and dissolute life. For a time he was court poet to Emperor Frederick III, who appointed him secretary in the imperial chancery in Vienna. In 1445 he was reconciled with Eugene IV and began his career in the Church. In 1447 he was appointed bishop of Trieste, and in 1456 he was made a cardinal by Calixtus III. He succeeded the latter as pope in 1458 and immediately began to crusade against the Turks, unsuccessfully seeking support from various powers. In 1460 he published a papal bull condemning as heretical the doctrine that church councils were superior to papal authority. His writings, particularly his memoirs, are highly regarded.

Pius IV (GIOVANNI ANGELO MEDICI), pope (1559-65), born in Milan, Italy, March 31, 1499; died in Rome, Dec. 9, 1565. It is uncertain whether the Milan Medicis were related to the great Florentine family, but after the election of Giovanni Medici to the papal throne the Florentines claimed kinship. Giovanni Medici held important offices under three popes, Clement VII, Paul III (who created him cardinal), and Julius III; but he was in disfavor with his immediate predecessor, Paul IV. Their differences worked to his advantage, however, for when the conclave of cardinals found itself deadlocked, it was these differences that led the cardinals to turn to Medici (Dec. 25, 1559). The most important event of his reign was the reconvening of the Council of Trent (see *Trent*) in 1562, which concluded a final break with the Protestants. Pius IV supported its decisions and brought about

other reforms in the Church. His nephew, St. Charles Borromeo (*q.v.*), was papal secretary of state.

Pius V, SAINT (MICHELE GHISLIERI), pope (1566-72), born in Bosco, Italy, Jan. 17, 1504; died in Rome, May 1, 1572. The son of poor parents, he entered (1528) the Dominican Order, where he taught theology and philosophy for 16 years. He was noted for his piety, austerity, and zeal. Pope Paul IV appointed him bishop of Sutri in 1556 and in the following year made him a cardinal and inquisitor general. Succeeding Pius IV on Jan. 7, 1566, he put into effect the decisions of the Council of Trent (see *Trent*), enforced a rigid standard of morals in Rome and the Papal States, supported the Inquisition (*q.v.*), and persecuted both Jews and Christians who refused to embrace Catholicism. He excommunicated Elizabeth I of England because of her rejection of Catholicism and her persecution of Catholics.



PIUS V

In the latter part of his pontificate, Pius V effected an alliance between Venice and Spain for the purpose of fighting the Turks and raised money for their campaign, thus contributing to the great naval victory at Lepanto (*q.v.*). He was beatified in 1672 and canonized in 1712.

Pius VII (BARNABA CHIARAMONTI), pope (1800-23), born in Cesena, Italy, Aug. 14, 1740; died in Rome, Aug. 20, 1823. He received his early education in the college for nobles in Ravenna and at the age of 16 joined the Benedictine Order; later he taught at Benedictine colleges in Parma and Rome. In 1785 he was appointed cardinal. He succeeded Pius VI on March 14, 1800. His primary concern as pope was with France, where the Revolution had created religious anarchy. To improve the situation, he negotiated the Concordat of 1801, but its terms were weakened by the Organic Articles appended by Napoleon I in 1802. In 1804, however, Napoleon forced the pope to come to Paris to consecrate him as emperor. Relations between France and the Vatican deteriorated rapidly thereafter; Rome was occupied by French troops in 1808, and France annexed the Papal States of Ancona, Macerata, Fermo, and

Urbino in 1809. In the latter year Pius was taken prisoner by Napoleon and held until 1814. After Napoleon's downfall, Pius disavowed the concessions he had been forced to make and returned to Rome. He promptly restored the Jesuits (*q.v.*) and revived the Inquisition and the *Index Librorum Prohibitorum* (*qq.v.*). The Congress of Vienna (*q.v.*) restored the Papal States to Rome. During the latter part of his reign, Pius VII did much to improve world opinion of the Church and the papacy. He was visited by many of the royal rulers of Europe, and he regained much influence. His leniency to the family of Bonaparte and his intercession for Napoleon himself won him wide admiration.

Pius IX (GIOVANNI MARIA MASTAI-FERRETTI), pope (1846-78), born in Sinigaglia, Italy, May 13, 1792; died in Rome, Feb. 7, 1878. He was educated at the Coll. of Piarists and in 1814 tried unsuccessfully to join the Roman guard. He then studied for the priesthood and was ordained in 1819. He was appointed archbishop of Spoleto, Italy, in 1827 and cardinal in 1840; on June 16, 1846, he succeeded Gregory XVI as pope. Representing the liberal group in the Church that favored papal reforms, he issued a political amnesty to 2,000 prisoners as one of the first acts of his pontificate. He sought to establish a combined clerical and civil administration in Rome; and in 1848, when the revolution for national liberation erupted in Italy, he lost popular support by refusing to sanction a war against Austria. The papal guard was disbanded, and the pope was put under the "protection" of the civil militia. He escaped and fled to Gaeta, where he solicited the support of France and Austria. Supported by France, he returned to Rome in 1850 and restored prerevolutionary conditions, thereby further alienating the Italian nationalists. In 1861 Victor Emmanuel II became king of a unified Italy (*qq.v.*); and, with the withdrawal of French troops from Rome in 1871, the Papal States were unified with Italy. Papal authority was restricted to a small area within Rome. The Church did not accept this situation, however, and Pius IX and subsequent popes considered themselves prisoners in the Vatican. The problems involved became known as the Roman question, which was not settled until the Lateran Treaties (*q.v.*) were signed in 1929.

One of the notable acts of the reign of Pius IX was the papal bull issued in 1854 declaring the dogma of the Immaculate Conception of the Virgin Mary. Another was the assemblage of the Vatican Council (*q.v.*) held in 1869-70, which established the doctrine of papal infallibility. This doctrine contributed heavily to the conflict between Church and State in Germany. The struggle (called *Kulturkampf*) arose from the determination of Bismarck (*q.v.*) to strengthen

the power of the empire by weakening the power of the Church. Bismarck took steps to regulate the Catholic clergy by laws carrying harsh penalties for violation. Pius IX declared the laws invalid, thereby further antagonizing the German government; and the struggle was still in progress at the end of his pontificate.

Pius' early liberalism in ecclesiastical affairs changed during his reign to a position of extreme conservatism. On Dec. 8, 1864, he issued an encyclical letter titled *Quanta cura*, in which he claimed wide control for the Church over education, science, and the arts and rejected freedom of worship for all other creeds. His pontificate of 32 years is the longest to date.

Pius X, SAINT (GIUSEPPE SARTO), pope (1903-15), born in Riese, Italy, June 2, 1835; died in Rome, Aug. 20, 1914. Born of humble parents, he began his education at the gymnasium of Castelfranco Veneto and in 1850 entered the seminary of Padua. He was ordained a priest in 1858, appointed bishop of Mantua (1884), and made cardinal and patriarch of Venice (1893). He succeeded Leo XIII to the papacy on Aug. 4, 1903. His pontificate was marked by the issuance of several important encyclical letters, including denunciations of ecclesiastical modernism (1905 and 1906). The increasing interference of the French government in Church affairs (typified by its regulation of Church property, education, and customs) brought about a crisis in which the

PIUS X

Wide World Photo



PIUS XI

pope ordered the French clergy to give up Church properties rather than submit to state laws. Among other important acts, Pius X established a seminary in Rome, set up a commission to retranslate the Bible and another to make a new study of its interpretation, revised the Roman breviary, and codified canon law. He was noted for his vigorous defense of the Catholic faith, his removal of negligent bishops, his piety, and his intense interest in the common people. Pius X was beatified in 1951 and canonized in 1954.

Pius XI (AMBROSE DAMIEN ACHILLE RATTI), pope (1922-39), born in Desio, Italy, May 31, 1857; died in Rome, Feb. 10, 1939. He was educated at the seminaries of San Pietro Martire and of Monza, Italy, at the College of St. Charles in Milan, and at the Gregorian Univ. in Rome. He was ordained a priest in 1879 and subsequently taught at the Great Seminary in Rome and became a member of the college of doctors of the Ambrosian library, which he later directed. In 1912 Pius X made him vice-prefect of the Vatican Library and promoted him to the canonry of St. Peter's. In 1919 he was appointed papal nuncio to Poland; in 1921 he was made archbishop of Milan and a cardinal. He succeeded Benedict XV on Feb. 6, 1922.

His pontificate was distinguished by two important concordats. The first, the Lateran Treaties (*q.v.*), signed with Italy in 1929, settled the Roman question (see *Pius IX*) and harmonized relations between the Church and Italy, which then recognized the independent state of Vatican City (*q.v.*). The second, signed in 1933, established relations with the Hitler government in Germany, which, however, never lived up to its obligations. In 1937 Pius XI denounced the German government and the National Socialist movement in an encyclical letter. In the same year he issued a powerful denunciation, "On Atheistic Communism." Pius continually urged social justice (*e.g.*, in his encyclical "*Quadragesimo anno*" in 1931), high moral standards among the faithful, and the establishment of international peace.

Pius XII (EUGENIO MARIA GIOVANNI PACELLI), pope (1939-58), born in Rome, Italy, March 2, 1876; died at Castel Gandolfo outside Rome, Oct. 9, 1958. His parents were members of old families closely connected with the Vatican. Graduated from the Pontifical Gregorian Sem., he was ordained in 1899 and subsequently took a degree in jurisprudence. After teaching law, he was made a domestic prelate in 1904 and began to work with the Congregation for Extraordinary Ecclesiastical Affairs (the Vatican state department); he was made under secretary of state in 1914. Named titular archbishop of Sardes and papal nuncio to Bavaria in 1917, he remained in Germany and was made nuncio to the German Republic after World War I. In 1929 he arranged



Courtesy Soc. for the Propagation of the Faith

PIUS XII

the conclusion of a concordat with Prussia. A cardinal after 1929, he became secretary of state in 1930. In succeeding years he traveled widely throughout the world, visiting the U.S. in 1936. On March 2, 1939, he succeeded Pius XI.

As pope, Pius XII continued to work for international peace and to stave off World War II—his personal motto, *Opus Justitiae Pax*, means "The Work of Justice is Peace." His first encyclical letter (September 1939) condemned totalitarianism. Outside this sphere, the pope's reign was marked by the pronouncement (1950) of the dogma of the bodily assumption of the Virgin Mary and by a scholarly encyclical (1943) on the concept of the Church as the mystical body of Christ. He commented on many scientific matters, including the proper and improper uses of nuclear energy (1957). He raised the college of cardinals to a complement of 70 in 1953 and canonized Pope Pius X in 1954, among 33 canonizations for his entire reign. In his last encyclical (1958), Pius XII announced the automatic excommunication of all Chinese prelates who took part in the appointment and consecration of bishops without papal permission.

Pixy (*pīk'sī*), a mischievous sprite. See *Fairy Tales*.

Pizarro (*pī-zār'ō*), FRANCISCO, discoverer and conqueror of Peru, born in Trujillo, Spain, in 1471(?); died in Lima, Peru, June 26, 1541. An able soldier and adventurer, Pizarro sailed to seek his fortune in the New World in 1509 and took part in various exploratory expeditions. He was with Balboa (*q.v.*) on the expedition that discovered the Pacific Ocean in 1513.

In 1519 Pizarro formed a partnership with Diego de Almagro (*q.v.*) to explore the land to the south of Panama, which was rumored to contain fabulous wealth. In two expeditions (1524-25 and 1526), Pizarro established the truth of these rumors, but his party was not large enough or well enough equipped to conquer the great

Inca civilization. After intense hardships on the route, Pizarro returned to Panama to lay further plans for conquest. Returning to Spain, he won the assistance of the king and the right to rule the Inca territory when he had conquered it. With his associates, his half-brother Gonzalo Pizarro (*q.v.*), and a force of some 180 men, Pizarro sailed for Peru and penetrated the Andes to the Inca capital of Cuzco. He was received with friendliness by Atahualpa (*q.v.*), the Inca ruler, whom he betrayed and held for ransom. Despite the payment of a huge indemnity for Atahualpa's release, Pizarro had him put to death.

As ruler of Peru, Pizarro established many new settlements, including Lima, which he made the capital in place of Cuzco. Soon, however, Almagro began making demands for possession of the territory, particularly for the governorship of Cuzco. In the civil war that developed, Pizarro's supporters defeated those of Almagro, and the latter was executed in 1538. Pizarro continued his efforts to wipe out Almagro's followers, but three years later, through a plot, he himself was assassinated in the palace of Lima. Pizarro's reputation for personal courage and military leadership were offset by his treachery, cruelty, and greed. In addition to Gonzalo, two half brothers accompanied him on various adventures; they were Hernando (1475?-1578) and Juan (1500?-36).



Courtesy Brown Bros., N. Y.

FRANCISCO PIZARRO

Pizarro, GONZALO, soldier and adventurer, half brother of Francisco Pizarro (*q.v.*), born in Trujillo, Spain, *ca.* 1506; died in Cuzco, Peru, April 8, 1548. He was an officer in the expedition that conquered Peru and later helped de-

fend Cuzco against Almagro. He became governor of Quito in 1539; and, in the following year, he took over the command of a two-year expedition that explored the Amazon River. Returning to Quito, he remained as governor. In 1544 he led a revolt against the new Spanish viceroy, Blasco Núñez Vela, who was killed in battle as his troops were defeated. Gonzalo assumed the rule of all Peru, but the king soon sent another representative, Pedro de la Gasca, who offered an amnesty to all the revolutionists. Pizarro's supporters defected, and he was forced to surrender. He was subsequently beheaded.

Placenta (*plā-sēn'tā*). See *Birth; Embryology*.

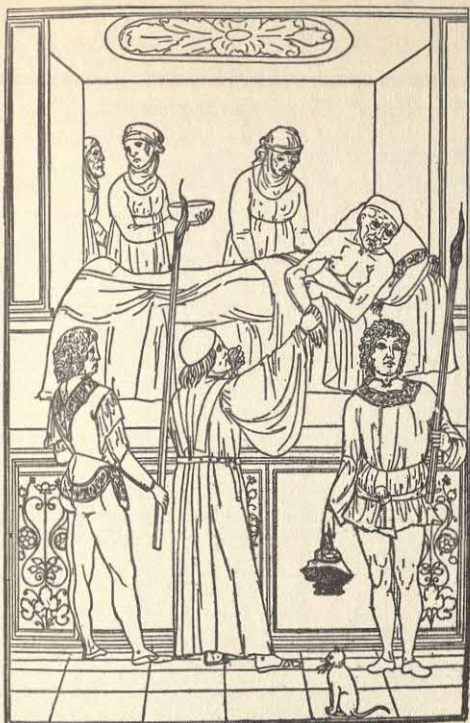
Placer (*plās'ēr*), a deposit of gold or other minerals found in sands or gravels, as distinct from minerals in veins or lodes. Placer mining is the operation of retrieving such minerals, as by washing.

Plague (*plāg*), a malignant, highly contagious disease, now known to be caused by the *Bacillus pestis*, discovered (1894) by Shibasaburo Kitasato (1856-1931), a Japanese physician. Especially threatening eastern Asia, the disease has also occurred epidemically in Europe and Asia Minor. The bacillus infects the blood and may cause inflammation of lymphatic glands, known as *buboes*. Thriving in dirt, moisture, etc., the infection is spread by rats, fleas, contaminated food, water, air, or insects such as flies, bugs, ants, etc. The illness varies from a slight indisposition, sometimes not even observed, to the most extreme violence, usually followed by death. Incubation takes from three to eight days; the symptoms are headache, shivering, general weakness, and fever. The weakness may be accompanied by mental disturbances and delirium, leading to coma. Dark spots frequently appear on the skin, resulting from subcutaneous hemorrhages. The most notable characteristic, however, is glandular swelling, mostly in the armpits, neck, and groin.

During the Middle Ages, the word "plague" was applied generally to all fatal epidemics; it is now limited to the *Bacillus pestis* infection in its many varieties, best known of which are the *bubonic* and *pneumonic* plagues.

Unfortunately there is no known specific effective in combating the plague; protection is to be found chiefly in cleanliness, health inspection, isolation, and disinfection.

This disease was first recorded in a fragment from the time of Trajan (A.D. 52-117) in which the physician Rufus of Ephesus describes the buboes as pestilential, highly malignant, and prevalent in Egypt, Libya, and Syria. Although this would indicate that the plague appeared in the northern part of Africa rather early, it did not occur in Europe before the 6th century A.D., when a tremendous outbreak threatened the Roman empire. From that time onward, large



THE PLAGUE

Italian woodcut, 15th century

parts of Europe have been repeatedly ravaged by this disease.

The city of London has been particularly unfortunate in being visited by the plague. Estimates place the loss of lives at London in 1603 at 36,270; in 1625, at 35,500; in 1636, at 13,485; and in 1665, at 68,596. Other notable ravages of the plague cost Marseilles 60,000 lives in 1720; and Messina, 43,500 in 1743. In 1771 it visited Russia, the Scandinavian peninsula, Germany, and many other regions of Europe. A disastrous plague appeared in Egypt in 1844, and another raged in southeastern Russia, Arabia, Persia, and Tripoli in 1878-79. Hong Kong suffered from an epidemic in 1894; it ravaged the Bombay area from 1896-1908, and reached Western Europe, in a less severe form, in places such as Lisbon and Glasgow. The disease still prevails in parts of China and Africa, and is potentially dangerous in any part of the world. Seaport authorities especially take strenuous precautions to destroy infected rats before they can carry the disease ashore.

Plain (*plān*), one of the great natural divisions of the land, the others being plateaus and mountains. The term plains includes all portions of land areas that are less than 1,000 ft. above sea level, while the remaining portions of the land masses are usually classed as plateaus and mountains, though some writers extend the name to include level or undulating regions of greater

altitudes. Many of the great plains are adjacent to the coast, rising gradually from the sea and extending inland until they merge into plateaus. North America has two extensive plains, extending north and south through the continents, being divided a short distance south of the Canadian line by the Height of Land. The portion lying north is included in the Arctic plain and the part lying south, extending from Minnesota to the Gulf of Mexico, is almost entirely in the Mississippi basin. Along the Atlantic coast is a narrow coastal plain, which is separated from the Appalachian Mts. by the Piedmont plain. On the western coast of North America the plain is very narrow or entirely absent, the land rising quite abruptly from the shore and merging into the Coast Range and other mountains.

The largest of the extensive plains is in the northern part of Eurasia, being included chiefly in Siberia and European Russia. It is comparatively narrow in the eastern part, where ranges of the Stanovoi Mts. lie near the shore of the Arctic, but it gradually widens toward the west and central Europe. Much of the interior of Africa is included in the central plains, such as the Sahara and the Sudan. The great plains of South America are in the basins of the Amazon and the Rio de la Plata, but the former is much the larger and more important. Australia is principally an elevated plateau, and the only plain of considerable extent is in the basin of the Murray and the region of the lakes in the southern part. Many great plains formerly were the beds of lakes or the floors of shallow seas, hence these are commonly called *marine plains*. Other plains were formed by various causes acting through long periods of time. Lowlands covered with ice and snow, as in Greenland, are usually called *ice plains*. These formed by the extensive outflow of lava, as in southern Idaho, are called *lava plains*. Where large rivers build broad tracts of land by the deposit of silt, as in the deltas of the Ganges and the Mississippi, they give rise to *flood or fluvial plains*. The lowlands that have been above the sea for a long period, as a great part of the Sahara, are acted upon by the winds and other climatic conditions causing erosions, and thus finally developed into what is known as *plains of inundation*.

The great plains are highly important to man in commerce and industry, since the soil in most cases is highly fertile. This gives rise to agricultural development, which is confined largely to the regions classed as plains. This circumstance, together with the fact that they contain the most important navigable streams and have surfaces well adapted to the building of railways, has caused them to contain the greatest density of population. Extensive fields of bituminous and lignite coal and deposits of lead, zinc, and iron

ores are among the minerals. Large areas are covered with valuable forests, and extensive regions are noted for their growth of blue grass, blue stem, and other nutritious grasses.

Plainfield (*plān'fēld*), a city in Union County, New Jersey, ca. 25 m. s.w. of New York City. It is served by the Central of New Jersey and the Baltimore & Ohio R.R.'s. Located in the center of an agricultural area, it produces clothing and hosiery, automotive vehicles, chemicals, electrical and electronic products, printing presses and other machinery, and plastics. Settled ca. 1685, Plainfield was incorporated as a city in 1869. Population, 1940, 37,469; 1950, 42,366.

Planck (*plāngk*), MAX KARL ERNST LUDWIG, physicist, born in Kiel, Germany, April 23, 1858; died in Göttingen, Oct. 4, 1947. Appointed professor of physics at the Univ. of Kiel (1885), he served in the same capacity at the Univ. of Berlin (1899-1926) and, later, was also director of the Inst. for Theoretical Physics in Berlin. His studies of radiations from black bodies resulted, after 1901, in his formulation of the important quantum theory (*q.v.*). Briefly, the quantum theory proposes that light is not a continuous wave but is separated into tiny bundles of energy, or quanta, which follow a wave pattern. The amount of energy contained by each quantum is proportional to the frequency of the light wave, so that the higher the frequency, the greater the energy of the quantum. Thus the energy in a quantum is a constant (called Planck's constant) multiplied by the frequency of the light wave. The numerical value of this constant is 6.55×10^{-34} joule-second, or $6.55 \times$

10^{-27} erg-second. A quantum is also called a *photon*. By enunciating this theory, Planck developed a completely new concept in physics and, except for Albert Einstein, did more than any other scientist to explain the structure of the universe.

Planck also did important research in connection with thermodynamics, mechanics, and the electrical and optical aspects of the radiation of heat. He published a number of definitive books on his own researches, lectured at Columbia Univ. (1909), and was awarded the Nobel Prize for physics in 1918.

Plane (*plān*), a flat or level surface, having but two dimensions, length and width. Plane geometry is the study of two-dimensional figures. Plane trigonometry is the study of triangles or angles which lie in two-dimensional space.

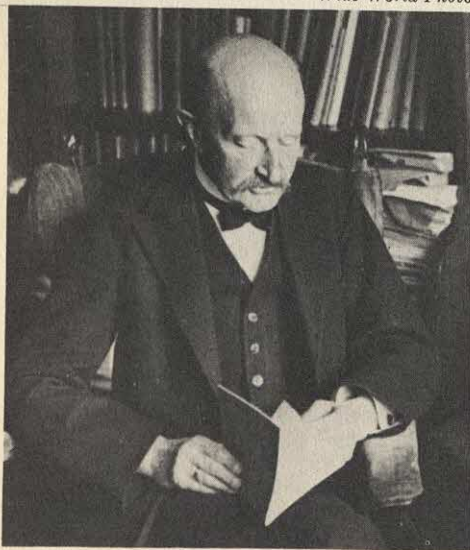
Plane, a tool used by carpenters and joiners for cutting the surface of wood, either to make it smooth or to make the shape correspond to that of the cutting edge of the plane. Planes used to cut only flat surfaces are called *bench* or *surfacing planes*, while those for shaping and forming are known as *grooving* or *molding planes*. They are formed of a solid block of hardwood, called the *stock*, which has a wedge-shaped hole cut from the upper to the lower side, in which is adjusted the plane iron or chisel. A wooden wedge is used to secure or fasten the chisel, which is kept sharp for cutting. A handle of wood or iron is attached to the back part of the plane, so that it may be pushed with force when in use. Some planes are made, on the same general pattern, entirely of metal. *Jack planes* are about 15 in. long and are used for the rougher work, while *jointers* are from 22 to 24 in. long and serve to give straightness and accuracy to the surface.

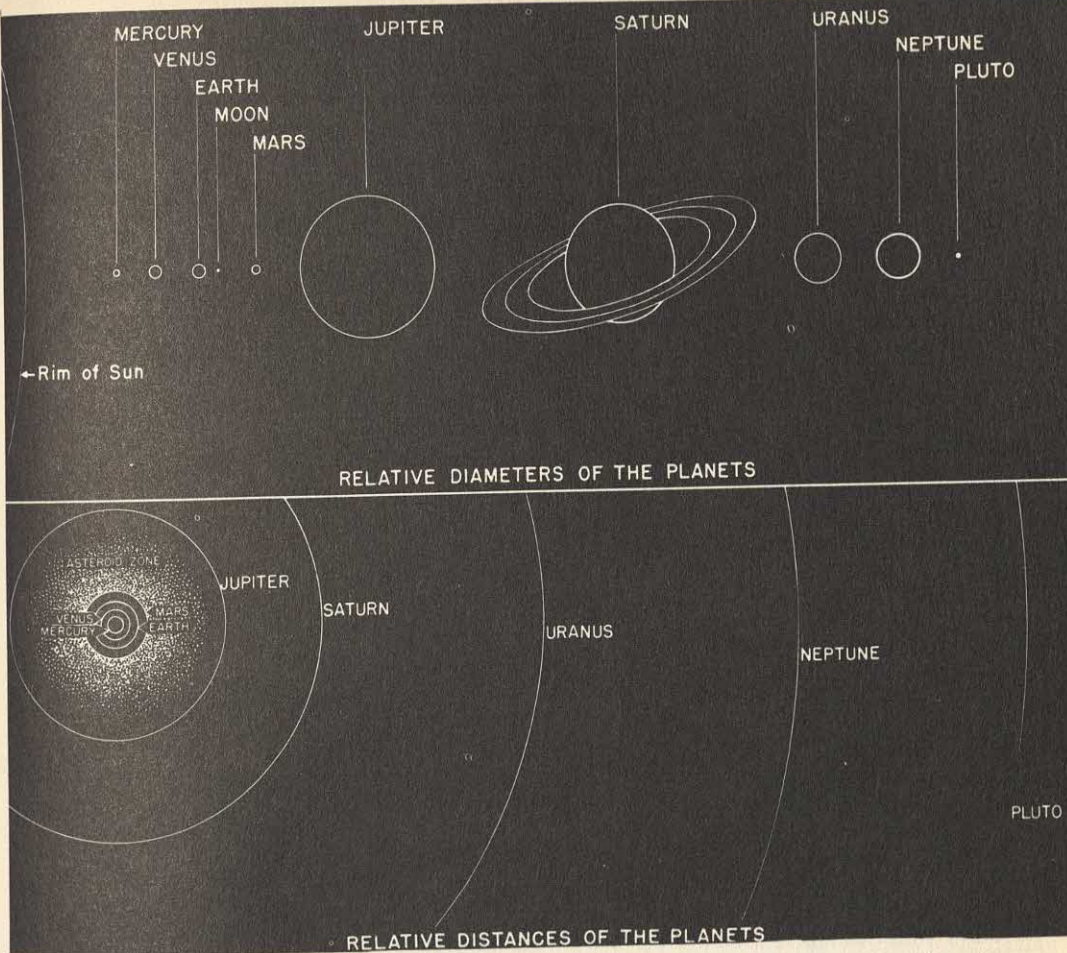
Planet (*plān'ēt*), one of the celestial bodies that revolve around the sun and receive light and heat from it. The planets are separated into primary and secondary, the former revolving around the sun and constituting the planets proper, the latter turning around the primaries and being known as *satellites*. Both planets and satellites are dark bodies; the light they give off is merely reflected sunlight. Both shine with a steady radiance. Although much fainter than stars, the planets appear brighter because they are closer to the sun and to the earth.

The planets usually are classified as *inferior* and *superior*. The inferior planets are Mercury and Venus, whose orbits are within that of the earth; the superior planets are Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto, whose orbits are greater than that of the earth. In addition to the so-called *major planets*, there are in the solar system many hundreds of much fainter and smaller ones which are invisible to the

MAX PLANCK

Wide World Photo





naked eye. These revolve around the sun, mostly between the orbits of Mars and Jupiter, and are called *minor planets*, or *asteroids* (see *Asteroid*). Neptune was discovered by Johann Galle, in 1846; its position was calculated by John C. Adams and Urbain J. J. Leverrier. Pluto, a planet which was long thought to exist beyond the orbit of Neptune, was discovered by Clyde W. Tombaugh on March 13, 1930, at the Lowell Observatory, Flagstaff, Ariz.

See separate articles for each of the major planets; for artificial planets, see *Astronautics*;

Earth Satellite. The chart (above), courtesy American Museum—Hayden Planetarium.

Planetoid (*plăn'et-oid*). See *Asteroid*.

Plane Tree or SYCAMORE, a genus (*Platanus*) of forest trees, generally known as *buttonwood* in America. The buttonwood native to North America is one of the largest deciduous trees on the continent and is found in the forests skirting the rivers of the central part. Along the Ohio River, the trees of this genus have diameters of from 10 ft. to 14 ft. and are without branches to heights of from 50 ft. to 70 ft. The leaves are palmate and alternate. The wood is fine-grained; when seasoned it assumes a dull red color and takes a good polish, but its liability to decay when exposed to the weather makes it of comparatively small value for many purposes. It is still used, however, for making butcher's blocks because it resists splitting. The plane tree of Europe is quite similar to that of North America and was a favorite among the Greeks and Romans for ornamental and shade purposes. It is still planted in many European cities, fine specimens being numerous in Constantinople, Rome, Vienna, Berlin, London, and Paris. The London plane tree, a hybrid between the orien-

Planet	Mean Distance from the Sun, in Millions of Miles	Equatorial Diameter in Miles	Length of Time Taken for Revolution around Sun	Length of Time Taken for Rotation on Axis	Number of Known Moons
Mercury	36	3,200	88 days	88 days (?)	0
Venus	67	7,848	225 days	(?)	0
Earth	93	7,927	365½ days	23 hr. 56 min.	1
Mars	142	4,268	687 days	24 hr. 37 min.	2
Jupiter	484	89,329	12 years	9 hr. 50 min.	11
Saturn	887	75,021	29½ years	10 hr. 14 min.	9
Uranus	1,784	33,219	84 years	10 hr. 40 min.	5
Neptune	2,795	27,700	165 years	15 hr. (?)	2
Pluto	3,675	3,700	248 years	(?)	0
Sun	864,000	25 days	..

tal and American plane trees, is the one most frequently planted as a street tree in the U.S.

Plankton (*plāngk'ton*), a term applied to the masses of minute plant and animal life that float and cover huge areas of open ocean surface, especially in the warmer latitudes. One well-known plankton area is called the Sargasso Sea. The plants in these areas (called *phytoplankton*) are mostly one-celled and extremely minute; they are often brilliantly colored and phosphorescent. The plants serve as food for the animal forms, or zooplankton. The animals are of many kinds—foraminifera, radiolaria, and small crustaceans; under a low-powered microscope, they show extraordinary shapes. Much of the zooplankton drops down into deeper water during the day, rising to the surface to feed at night. The eggs of many larger creatures are deposited in plankton areas to hatch and pass the earlier stages of their lives.

Planned Economy (*plānd ē-kōn'ō-mī*), an economic system under which a country's economy is entirely or partially state controlled. The outstanding contemporary example is Soviet Russia. Historical examples are found in the religious and utopian colonies which sprang up in both Europe and America during the 17th, 18th, and 19th centuries. Great Britain, under the Labour government, adopted a planned economy in 1945.

Plant (*plānt*), a botanical term. See *Botany*; *Plants*.

Plantagenet (*plān-tā'ē-nēt*), the surname of a line of kings of England, who occupied the English throne longer than any other dynasty. The name originated with Geoffrey, Count of Anjou, whose custom it was to wear a sprig of broom (*plante de genêt*) in his bonnet. Geoffrey married Matilda—a daughter of Henry I—who claimed the throne for her son Henry. As Henry II, the first Plantagenet king, her son ascended the throne in 1154, on the death of Stephen, grandson of William the Conqueror. Richard II, deposed in 1399, was the last Plantagenet king in the direct line. The name was used, however, by the houses of York and Lancaster, who contested the throne in the Wars of the Roses, so that the dynasty may be said to have continued until the accession (1485) of Henry VII, first king of the house of Tudor. For a list of the kings of this period, see *England*. See also *Angevin*; *Roses*; *Wars of the*, and separate articles on the important kings.

Plantain (*plān'tin*), a genus (*Plantago*) of plants distributed abundantly in all parts of the world. They include about 100 species and are most abundant in the temperate regions. Many of them are common weeds. The *greater plantain* is widely distributed in the U.S. and Canada. It is a perennial with broad leaves, arranged

in a basal rosette, and cylindrical spikes, bearing a large number of seeds of value as bird food. The narrow-leaved and the greater plantains are two of the most obnoxious and persistent lawn weeds. Both of these were introduced to America from Europe.

Plantain, a tropical plant (*Musa paradisiaca*) allied to the banana (*q.v.*), which is native to India. The plant consists of long, overlapping leafstalks and bears a stem from 4 ft. to 20 ft. high. The leaves grow to a length of 6 ft. and a breadth of 2 ft., and the fruit is delicious and thoroughly wholesome. It grows in clusters weighing from 40 lb. to 60 lb., each separate plantain of the cluster being about 1 in. in diameter and somewhat longer than a banana, differing from the latter in not having purple spots on its stem. A further difference is that the banana is usually eaten raw, while the plantain is generally cooked. When roasted and eaten before maturity, it resembles the potato in taste and the powdered dried fruit is quite similar in flavor to rice. Many inhabitants of tropical regions subsist almost entirely on this fruit. The *abacá* or *Manila hemp* (*Musa textilis*) is derived from a species related to the banana and the plantain and is one of the finest and strongest fibers known. It is used largely in making cloth and cordage.

Plantation (*plān-tā'shun*), in English history, a term used to refer to a colony, principally in North America and the West Indies. It was widely used in pre-Revolutionary days and still survives in the official name of Rhode Island—the State of Rhode Island and Providence Plantations. In the agricultural economy of the southern U.S., the plantation was an important unit. Most of the great plantations gave way with the transition to increased industrial activity, but the term is still used to mean a large estate held in private or corporate ownership.

Plantin (*plān-tān'*), CHRISTOPHE, printer, born in St. Avertin(?), France, 1520(?); died in Antwerp, the Low Countries, in 1589. He established presses in Antwerp, Leyden, and Paris which were renowned for the beauty of workmanship in the books produced. The best-known of Plantin's editions is the *Biblia Regia*, a polyglot Bible (8 vols., 1569-73). The Plantin-Moretus Museum in Antwerp is on the site of his shop there.

Plant (*plānt*), HENRY BRADLEY, railroad and steamship industrialist, born in Bradford, Conn., Oct. 27, 1819; died June 23, 1899. Privately educated, he went to work on a coast steamer at the age of 18 and later worked for the Adams Express Co. In 1861 he organized the Southern Express Co. He was the founder of the Plant system of railroads and steamboats, which he started by purchasing at foreclosure sales the

Atlantic and Gulf R.R. (1879) and the Charleston and Savannah R.R. (1880). Within 20 years he had built up a system that included 14 railroads, covering 2,100 m. of track, and several steamship lines and hotels. By making Tampa, Fla., a railroad terminus and U.S. port for a steamship line to Havana, Cuba, he was largely responsible for the growth of a village into a thriving city. A luxurious hotel built by Plant is now the home of the Univ. of Tampa.

Plant Louse (*plānt lows*), also called **APHID** and **GREEN FLY**, a member of a very large family of insects, the Aphididae of the order Homoptera. They are elongate or robust, soft-bodied, mostly under one-quarter of an inch in length, naked or covered with waxy secretions, and fitted with sucking mouth parts. Many species are green, but others are yellow, red, or black. They range all over the world, except the extremely cold regions. Practically no species of plant life is free from attack by one or more aphid species, for they feed upon the sap of leaves, stems, twigs, and even bark. Some cause characteristic galls. Honey dew, a sweetish secretion, much sought after by ants, bees, and flies, is produced by many plant lice through a pair of cornicles on the abdomen. There are many forms within a single species, of which the following are the most commonly seen: *fundatrices*, or stem mothers, wingless or winged, viviparous, parthenogenic females developing from overwintering eggs; *migrants*, winged, viviparous, parthenogenic females, able to distribute the species by flying to new host plants; *sexuales*, usually winged males and females, which mate and produce the eggs in which the species passes the winter or the dry season. With their various ways of reproduction, plant lice increase tremendously. It is only by their many enemies, such as lady beetles, aphid lions, parasites, wasps, and birds, that they are kept in check.

Plants (*plānts*), living organisms belonging to the plant kingdom, as distinguished from animals of the animal kingdom. Among the characteristics which differentiate plants from animals is the nature of the cell wall (see *Cells*). In plants the wall is firm and made of cellulose (*q.v.*), a substance not found in animals. In contrast, the animal cell is bounded by a thin layer of firm cytoplasm. Most plants possess the pigment chlorophyll (*q.v.*); animals do not. Some plants, such as the bacteria and fungi, have lost their chlorophyll and have secondarily become saprophytic or parasitic, but most authorities believe that they evolved from plants bearing chlorophyll. One of the major differences between members of the two kingdoms is the mode of nutrition. Green plants manufacture their food from simple raw materials in the environment. In the process of photosynthesis (*q.v.*),

which requires chlorophyll, the carbon dioxide gas from the air and water from the soil are converted, in the presence of light, to carbohydrates. These compounds can then be changed by the plant to all the many complex compounds needed in its life processes. Animals, on the other hand, usually ingest solid particles of already complex compounds; they cannot form food from simple environmental materials. All animals are, in effect, eventually dependent on the photosynthetic activities of green plants. A few of the bacteria, although they lack chlorophyll, also have the ability to synthesize complex compounds from simple substances.

Recent estimates of the number of different species of plants show that there are approximately 350,000. Authorities differ as to the exact classification of this large number of organisms, but, in general, one can divide them into four major groups.

The *algae* (*q.v.*) are a large group of primitive, chiefly aquatic, plants that are subdivided on the basis of their predominating pigments into green, blue-green, brown, and red algae. The latter two groups include the commonly known marine seaweeds. A few less well-known small groups are also included in the algae.

The *fungi* (*q.v.*) make up a second major group, the second largest in the plant kingdom. These plants lack chlorophyll and have assumed a saprophytic (living on dead organic matter) or parasitic (living on living organisms) mode of life (see *Parasites*). The bacteria, slime molds, and the true fungi are found here (see *Bacteriology*; *Slime Mold*). The lichens, which contain both algae and fungi, are usually placed in the latter group (see *Lichen*).

The *bryophytes* (*q.v.*) comprise a relatively small group of plants. These include the liverworts, mosses, and hornworts, small plants of the moist forest floor (see *Liverwort*; *Mosses*).

The *vascular plants* make up the fourth and final group. These are plants in which a well-developed conducting system has been evolved. The club mosses, horsetails, and ferns are included here (see *Ferns*; *Horsetail*). The highest-developed plants in this group are the seed plants. Classified among the seed plants are the *gymnosperms*—with conifers, cycads, and ginkgo—and the *angiosperms* or flowering plants. This last set of organisms is the dominant group of plants on earth today both in terms of number of species and complexity of structure.

Plants play a major part in man's economy, and they supply a vast array of products that are essential to modern civilization. The microorganisms, bacteria and fungi, not only are responsible for causing disease in plants and animals, but they also supply a diversity of useful substances. Bacteria aid in decay and produce

many chemical raw materials, such as acetic, butyric, propionic, and lactic acids. They play a part in the manufacture of dairy products, in curing of tobacco, in tanning of leather, and in the retting of flax and hemp. The fungi furnish antibiotics used in medicine, include yeasts (see *Yeast*) used in brewing and baking, and produce vitamins and other chemical compounds in daily use. The higher plants furnish wood and paper (*qq.v.*) essential in construction and communication. Fibers used in ropes and textiles, such as hemp, sisal, cotton, and flax, are plant products (see *Fiber*). The milky latex of the rubber tree is the source of a substance, rubber (*q.v.*), that finds wide use in modern industry and transportation. Other plant substances used by man include dyes, gums, resins, perfumes, flavors, oils, fats, waxes, and tobacco (see *Dyeing; Gum; Resins; Perfumes; Oils; Fat; Wax; Tobacco*). Plants have been a source of many important medicines. Among the more important of these are quinine, used in the treatment of malaria; morphine and cocaine, used to alleviate pain; and digitalis and strychnine, used in heart ailments.

Foods are probably the most important contribution of plants to man's existence. The cereal crops, such as wheat, rice, maize or corn, rye, oats, and barley (*qq.v.*), have been the major sustaining crops of mankind since civilization began. The root, stem, and leaf vegetables have added variety to the diet (see *Vegetable*). Fruits yield food and beverages of many kinds both to quench thirst and to provide varying degrees of stimulation (see *Fruit*).

Plasma (*plāz'mā*). See *Blood*.

Plasmodium (*plāz-mō'di-ŭm*), a genus of parasitic protozoans (order Sporozoa), which cause malaria (*q.v.*) in reptiles, birds, and mammals. Their complex life cycle requires that they be taken in their earliest stage from the blood of an infected animal into the stomach of a particular species of mosquito; in a later stage they must be transferred from the mosquito to the blood of an animal, where they create great damage. There are four species that are known to be parasitic on man. *Plasmodium* species probably cause more sickness than any other one genus of parasites. They cause 1,000,000 deaths a year in India. In the U.S. many cases occur during a year, but, because of better treatment methods, few die.

Plassey (*plās'ī*), a village in India, in the Nadia district of West Bengal State, on the Bhagirathi River, ca. 85 m. n. of Calcutta. It is in an agricultural area which produces rice and jute. Plassey is famous as the site of a battle (June 23, 1757) between some 50,000 troops of the Nawab (Moslem prince) of Bengal and a British force of 3,200 men under Robert Clive.

Clive's victory is credited with ensuring British dominance in India.

Plaster (*plās'tēr*), a mixture of lime, Portland cement, or gypsum with an aggregate such as sand, and water, which forms a hard coating as a finish for walls. Plaster is applied to a *base*, which may be of lath or of masonry. Three coats generally are used over metal or wood lath. The first, or scratch, coat and the second, or brown, coat usually are mixed with hair or fiber for greater strength. Stucco (*q.v.*) is a type of plaster used for outside walls. Plaster of Paris is a gypsum preparation that dries to a great degree of hardness and is used for making casts and molds. See also *Cement, Gypsum*.

Plastics (*plās'tiks*), a general word (from Greek *plastikos*, meaning "capable of being molded"), covering a wide variety of man-made organic resins which, alone or in combination with other materials, can be transformed by either heat or pressure, or both, into products with special characteristics and uses. More than 4,000,000,000 lb. of plastics are produced annually in the U.S. and additional millions of pounds abroad. These plastics materials are found in such diverse applications as radio housings and automobile lights, wall coverings and transparent films, dishpans and squeeze bottles, toothbrushes and swimming pools, upholstery fabrics and airplane parts, dinnerware and shoe heels, and trays, toys, and phonograph records. The list of uses is endless; the possibilities are unlimited.

The first synthetic plastic dates back to 1869, when John Wesley Hyatt (seeking a material to substitute for ivory in billiard balls) produced cellulose nitrate. Trade-named Celluloid (*q.v.*), it soon became famous in a variety of products, including celluloid collars for men, dental plates, spectacle frames, photographic film, buttons, and combs. Its uses were limited, however, by its brittleness and inflammability. It was not until 1909 that a plastic resin of more extended commercial significance was developed. This was Bakelite, devised by Leo H. Baekeland (*qq.v.*), an organic compound made of phenol and formaldehyde which, under heat and pressure, formed a strong, rigid material with excellent chemical resistance and dielectric (nonconducting) properties. It was soon found suitable for a wide variety of applications, including radio and telephone parts and housings, camera cases, handles, and knobs of all kinds. Today, some 550,000,000 lb. of phenolic resins are used annually.

All plastics are classified as either thermoplastic or thermosetting. Celluloid is an example of a *thermoplastic* resin; it can be repeatedly softened by heat, hardened by cooling. Bakelite is a *thermosetting* resin, i.e., it undergoes a



Courtesy Chicago Molded Products Corp.

VACUUM FORMING

Toy boat hulls of polystyrene

chemical reaction when molded under heat and pressure and when cooled will not soften again.

Whether thermoplastic or thermosetting, each plastic resin has its own characteristics and therefore its own applications. These characteristics are determined by the formulation of the resin, *i.e.*, the chemical elements that make it up (carbon, hydrogen, oxygen, fluorine, and chlorine are but a few) and the way they are combined. Thus, some plastics materials exhibit high impact and tensile strength; others possess good dielectrical properties, or resist heat or cold (or both), or are inert in the presence of a wide variety of chemicals. Some are chosen for their clarity or colorability, others for their ease of molding and ability to show fine detail. Some resins may be further modified by the addition of "fillers" such as wood flour, cotton, mica, asbestos—all of which affect strength, heat resistance, and wearability. Other resins may be modified by plasticizers—chemical agents which may make them easier to mold or which may increase their flexibility, elasticity, and resiliency. Dissolved in solvents, some plastics resins serve as protective or decorative coatings or are used to saturate and bind nonplastic materials such as wood or paper.

No one plastic shows optimum mechanical characteristics, chemical resistance, dielectric strength, heat resistance, colorability, and so on; rather, each material must be chosen for that combination of good properties (within, of course, given economical limits) which will best serve the desired end-product need. Thus, colorability, fine detail, impact resistance, and good dielectrical properties are demanded of a plastic which will go into a radio cabinet; high tensile strength and chemical resistance are not. Plastic pipe, on the other hand, must have good tensile strength, resistance to chemicals, resistance to heat and cold, and resistance to environmental stress (*e.g.*, cracking) to be acceptable; its colorability and dielectrical properties are generally secondary.

Plastics resins—generally handled in the form

PLASTICS

of powder, crystals, or granules—become finished products in many ways. The more important molding processes for thermosetting materials are compression molding, transfer molding, laminating, and low-pressure molding. In *compression molding*, the molding compound is placed in the mold cavity, the mold is closed, heat and pressure are applied, the part is cured, and then the mold is opened, and the product is removed and trimmed. In *transfer molding*, the compound is liquefied and then "transferred" through passages to the closed mold. In *high-pressure laminating*, layers of cloth, paper, or wood are saturated with the resin and then placed between heated platens and subjected to heat and pressure until the product is cured. Decorative work surfaces and counter tops are made in this way. In *low-pressure molding*, certain thermosets are applied to sheets of material such as glass fiber; the sheets are then "laid up" in the mold and cured under relatively low heat and pressure. Boat hulls, air ducts, and automobile bodies are made by this method.

Among the ways in which thermoplastic resins are formed, the most important are injection molding, extrusion, and vacuum forming. *Injection molding* is carried out by melting the resin in a chamber and then squirting it under pressure into a mold, where it quickly hardens to shape. In *extrusion*, the plastic is heated in a cylinder and is then forced continuously through a forming die (like toothpaste extruded from a tube). A moving belt carries the formed plastic away as it hardens. In *vacuum forming*, sheets of plastics are held in a frame, heated, and drawn down into or onto the mold by vacuum. Such molds, which can be very large and are relatively inexpensive to make, lend themselves to short production runs of such things as signs, displays, manikins, and toys.

Important *thermosetting* resins are the *phenolics*, useful not only for the molding applications already mentioned, but also valuable in the production of laminates, protective coatings, adhesives, foams, and plywood; the *ureas*, whose excellent chemical resistance, dielectrical properties, and colorability recommend them for closures, cosmetic boxes, radio cabinets, and appliance parts; the *melamines*, whose bright colors, stain resistance, and hard surfaces have made them a ready market in plastic dinnerware; and the *polyesters*, whose greatest market today is in low-pressure glass reinforced laminates whose high impact strength and light weight make them ideal for furniture, boats, aircraft parts, and luggage.

Volume-production *thermoplastic* resins include the polystyrenes, the cellulose, the acrylics, the nylons, the vinyls, and the polyethylenes. *Polystyrenes* are available as lightweight,

clear, colorful plastics whose easy moldability and economy fit them for such applications as disposable packages, cups, picnic supplies, toys, housewares, signs, and displays. Copolymerized with butadiene, they have recently made a place for themselves as impact-resistant materials for such uses as helmets, kick plates, tote boxes, and valve parts. The *cellulosics*, such as cellulose acetate, are used for colorful toys, knobs, electrical-equipment parts, shoe heels, and packaging items. The *acrylics* are notable for their clarity, impact strength, and resistance to chemicals, sunlight, and weathering. Typical uses are in taillight lenses, luminous reflectors, instrument panels, light diffusers, skylight bubbles, and decorative screens. The *nylons* are tough, resilient, chemical- and heat-resistant plastics especially useful in gears, bushings, and wire and cable jacketing. The *vinyls* are resistant to solvents, alkalis, and acids. Resilient, tough, and attractive, they have found a growing market in floor tiles, pipe and tubing, films and sheets, upholstery fabrics and foams, and phonograph records. The *polyethylenes* are flexible, durable, lightweight materials prepared by synthesis of ethylene at high temperatures and pressures. Their versatility, resistance to chemicals and moisture, strength, and comparative economy have rapidly raised polyethylene consumption. Typical applications are in chemical-industry pipe and tubing, toys, housewares, cable insulation, squeeze bottles, sheeting, and film. Polyethylene is the first of the polyolefins—long-chain giant molecules which open up a new era in plastics materials. One of the latest entries into the polyolefin family is isotactic polypropylene, a material whose molecules can be structured to end-product needs by specially devised catalysts.

INJECTION MOLDING

Housewares formed of polypropylene

Courtesy Montecatini Soc. Gen.



MAN-MADE FIBERS: Plastics are very closely related to many synthetic fibers. Thus the polyamides (nylon), the acrylics (Orlon), the polyvinyls (Dynel), the polyesters (Dacron, Fortrel, Kodel), polyethylene, and polypropylene fibers all have plastics counterparts widely used in film, sheet, and molded forms, as described earlier. Actually, synthetic fibers can be classified as either organic or inorganic. Glass fiber (supplied as either filament or staple fiber) is the leading inorganic fiber currently produced. Organic fibers are classified as *regenerated*, *derivative*, and *fully synthetic*. The fibers listed above are all fully synthetic.

Viscose rayon is an example of a *regenerated* cellulose fiber made from wood pulp or cotton linters by means of various chemical agents; it is easily dyed, has good properties, and is inexpensive. Acetate, an example of a *derivative* fiber, is a compound of cellulose and acetic acid. It has a smoother "hand" (*i.e.*, feel) than viscose rayon, is "woollike" in behavior, and is more wrinkle-resistant. Nylon, still the most widely produced "true" *synthetic* fiber, is a polymer of the salt resulting from the reaction of hexamethylenediamine with adipic acid. Its great strength, colorability, and ability to blend with other synthetic or natural fibers have given it use in a wide range of industrial, commercial, and consumer applications. Nylon is used in tire cords, ropes and cables, hosiery, suitings, underwear, sweaters, and in satins, taffetas, and marquisettes. The polyesters have made a place for themselves because of great strength, low water absorption, ability to resist wrinkles, and retention of shape wet or dry. The use of polyester blends has had a significant influence on the men's-wear industry in the U.S. See also *Fiber*.

In 1958 (most recent Census of Manufactures) there were 3,222 U.S. establishments manufacturing plastics products. In 1961 there were 139,015 workers employed in the plastics field, and the industry produced a value added by manufacture of \$1,275,651,000.

See also *Silicone*; *Synthetics*.

Plastic Surgery (*plás'tik sár'jēr-ē*), a surgical specialty that repairs or replaces damaged or abnormal tissue. The function of plastic surgery is the restoration of a part to normal, or as near normal as possible, in both function and appearance. Plastic surgery includes skin grafting and transference of tissue from one part of the body to another. When the surface injury is not too deep, the surgeon may repair it with thin sheets from the stomach or thigh. When more than skin is to be transferred, the flap method is used. This involves leaving one part of the graft connected to the donor site to nourish the transferred tissue until it gets its own blood supply. Plastic surgery is used for hare lip and cleft

palates, for facial scars left by burns, and for disfiguring birthmarks. In cases of injury, jawbones are fashioned from ribs, noses from cartilage, eyelids from neck skin, eyebrows and lashes from the hair behind the ear, lips from the mouth lining, and nostrils from ear lobes. If a color discrepancy occurs in transferring skin from the body to the face, color tattoo may be employed.

Although plastic surgery dates back to the Renaissance, and skin grafting is 2,500 years old, the great impetus to modern plastic surgery came with World War I, in repairing injuries to wounded soldiers. Methods were perfected in World War II.

Plata (*plá'tā*), RÍO DE LA, or RIVER PLATE, the estuary of the Uruguay and Paraná rivers in South America, between Argentina and Uruguay. At its mouth, on the Atlantic Ocean between Maldonado and Cape San Antonio, the estuary is *ca.* 130 m. wide; at Montevideo it is 60 m. wide, and at Buenos Aires *ca.* 25 m. wide. Its total length is *ca.* 225 m. An immense volume of water passes through the Plata, since its drainage area covers *ca.* 1,500,000 sq. m. It was discovered by Juan Díaz de Solís in 1516 and named by Sebastian Cabot, who explored it (1526-30).

Plataea (*plá-tē'a*), a city of ancient Greece, about 9 m. s. of Thebes, in Boeotia. It was located at the foot of the northern slope of Mt. Cithaeron, and between it and Thebes the Asopus River formed a natural boundary. The city is thought to have been built by the Thebans, but there was continual strife between the two territories. In 519 B.C. the Plataeans formed an alliance with Athens, and in 480 B.C. their city was destroyed by the Persians because they had assisted the Athenians in the battle of Marathon. The following year Aristides and Pausanias won a victory over the Persians under Mardonius at Plataea, in which the Persians were completely scattered. Plataea was besieged by an army of Spartans and Thebans in the Peloponnesian War and, after defending itself for two years, was compelled to surrender in 427 B.C., when the city was destroyed and many inhabitants were slain. Those escaping found safety in Athens but later returned to rebuild the city. Plataea had considerable importance as late as the 6th century A.D. Its ruins are near the present-day village of Kokhla.

Plateau (*plā-tō'*), a tract of land that is generally level (particularly in the early stages of its history) and elevated an appreciable height above the surrounding territory.

Most plateaus fall into two groups, when judged according to their origin: (1) those which were pushed up above their surroundings by the action of strictly mechanical forces within

the earth; and (2) those which were formed by the spreading of one sheet of volcanic lava (and, occasionally, volcanic ash) on top of another, until thicknesses of thousands of feet were reached. The Columbia River plateau is an example of the latter type. A third type of plateau is the mesa (*q.v.*), or tableland.

The rocks which underlie plateaus are not necessarily horizontal. The sheets of volcanic rock which make up lava plateaus are horizontal, and, frequently, the rocks which cap mesas are horizontal. The rocks of the Allegheny Plateau, however, were bent into the shape of a huge saucer by mechanical forces in the earth's interior before the action of rain, streams, and the acids released by decaying vegetation gave this plateau its flat upper surface.

The soil of many plateaus is highly fertile, but the larger regions of this type are located in the arid belt, and the soil is too dry to produce without irrigation. The streams, moreover, are usually in deep channels, so that it is difficult to conduct water to the general levels by artificial channels. The arid regions are confined largely to the plateaus; the surrounding mountains interfere with precipitation. These regions are often cut by canyons into tablelands, or by streams to form bluffs, as in the Bad Lands of North and South Dakota. In other localities the surface is sculptured by erosion processes to resemble mountains (*e.g.*, the Catskills of New York). Many high plateaus have abundant rainfall, however, and are covered with grasses or valuable forests, as in the western part of Canada and the U.S.

The plateaus of Asia, especially Tibet and the Pamirs, are the most extensive and highest in the world. Next to these range the Andean plateau of South America and the Rocky Mt. plateau of North America. In Central Asia, the land masses have a general altitude of from 10,000 ft. to 14,000 ft., but these are deeply cut by streams. The Colorado plateau, located between the Sierra Nevada and the Rocky Mts., ranges in height from 6,000 to 9,000 ft., while the plateau known as the Great Plains, located in the western part of the Mississippi Valley, immediately east of the Rocky Mts., is from 3,000 ft. to 6,000 ft. above sea level.

Recent oceanographic research has revealed the existence of submarine plateaus. Perhaps the most extensive of these is the flat-topped Mid-Atlantic Ridge, which runs from Iceland perhaps to the Antarctic. See *Ocean*.

Platinum (*plā'tī-nūm*), a grayish-white metal (element, No. 78; symbol, Pt; atomic weight, 195.23), found in the metallic state in rounded granules distributed through sandy deposits, and alloyed with the platinum metals. In the native state it occurs only in small, irregular grains

from the size of a pinhead to that of a pigeon's egg, although there are instances in which the deposits have weighed as much as 20 lb. Native platinum is not pure, and, besides containing traces of gold, iron, and copper, it is alloyed with several other metals which it resembles in certain properties, which are called the *platinum metals*. These embrace iridium, palladium, rhodium, ruthenium, and osmium. It is very heavy and is separated from sandy deposits by washing in a stream of water in the same manner in which gold is separated from sand. Platinum is very malleable and ductile, has a brilliant luster, and, while the heaviest of ordinary metals, is least expanded by heat. Its high degree of infusibility and resistance to the action of chemical reagents makes it a valuable metal for vessels used in chemical laboratories, such as evaporating dishes, crucibles, and capsules. It is important in the manufacture of electrical apparatus and as a catalyst in certain industrial processes. It is used in dentistry and jewelry making. Platinum is both rare and costly; it was first described in 1740.

The alloys of platinum are not numerous, but with silver it forms a fusible white alloy, which, however, blackens by working and is attacked by nitric acid. It melts in the oxyhydrogen flame and in the electric furnace. At a white heat it becomes soft and can be forged and welded like iron. The air does not affect it at any temperature. Its property of resisting the effects of ordinary heat renders it of value in electrical supplies and radio equipment. Platinum is obtained in the U.S.S.R., Canada, South Africa, the U.S. (California, Oregon, Alaska), and South America (especially Colombia).

Plato (*plátō*), Greek philosopher, born in Athens in 427 (?) B.C.; died there in 347 B.C. Of the four great schools of philosophy, he was the founder of the first, which was called the *Academic school*; while Aristotle founded the *Peripatetic*; Epicurus, the *Epicurean*; and Zeno, the *Stoical*. Plato's early life is not known, but it is certain that he received a good education, since he belonged to one of the first families of Athens. His mother is said to have been a descendant of Solon. From his 20th year to the time of the death of Socrates in 399, he was the favorite pupil of the latter, and he himself, as is clearly recognizable in his "Dialogues," regarded himself primarily as Socrates' student and follower. After the death of his master, he went to Megara, where he studied with Euclid. Later he went to Asia Minor and Egypt, where he studied the philosophy of the Pythagoreans, and finally to Sicily. When, at the age of 40, he returned to Athens, he founded a philosophical school which gathered in the gardens of a man named Academos, and thus it received the name Academy.

His teachings consisted of conversation with his students, not on a dry, "academic," professional level but enlivened by humor and figures of speech. Hence it was not surprising that not only his actual students but many others attended these philosophical discussions. The general interest went so far that even women, who were excluded from the gathering, disguised themselves as men in order to attend. Plato had learned from Socrates this heuristic, inductive method of teaching, which lets the mind of the inquirer find the solution to a problem for himself. It is interesting to remember that Aristotle became—due to his formal logic—the father of medieval philosophy. Although a student of Plato's, he did not follow Plato in his method of teaching. Aristotle strove for final, precisely formulated definitions which were communicated to his followers and, after his example, so did the scholars of the Middle Ages. Aristotle's ambition was the development of a finished system; Plato's was a continuously developing, never-ending approach toward its roots.

Plato is one of the few Greek philosophers whose works in a written form are well preserved. Allegedly there were 64 different books, of which we still have 44, some of them of doubtful authenticity. They are called the "Dialogues," after the form of conversation which gradually led the inquirer to the final definition he was seeking. How far each individual dialogue contains later interpolations and what should be their chronological order are questions which present problems for the history of philosophy.

All of the "Dialogues" are of utmost importance, from all three points of view—philosophical, literary, and linguistic. When we think of ancient Greek as a language and literature, we think foremost of Plato's prose. The names of the



PLATO

most important dialogues, in most of which Socrates is introduced as an active participant, are as follows: "Phaedrus," "Protagoras," and "The Apology"; "Phaedo," "Gorgias," and "Symposium"; "The Republic," "Timaeus," "The Laws," and "Critias."

Plato, in contrast to Socrates, was not interested primarily in problems of ethics and of the truth, but essentially in the problem of reality. From the solution of this foremost problem he wanted to solve the more specific ethical and epistemological problems. The "idea" as the condensation of all qualities which are common to a group of things is, in Plato's opinion, unchangeable (*i.e.*, there are elms, oaks, maples, willows, but the idea behind all of them is the idea of the tree). The individual things may vary, but they have one thing in common—the idea. Actually, it is only the idea which truly exists. Knowledge of truth exists and is therefore an idea. The idea of the good, of the beautiful, of the soul, of the state, are integrated and connected with each other, but it is only the ideas which are perfect. Our reality, of which we learn through our senses, is imperfect, but the ideas exist actually and are real beyond the world of the soul, of the state, are integrated and connected as by seers or poets in "holy madness," or through philosophy by integrated thinking. The mathematical sciences, logic, etc., are merely preparatory steps for this intrinsic, metaphysical concept of thought. The "doxa" (subjective opinion) means merely the changeable world of reality perceived by our senses but does not at all contribute to true knowledge. In other words: we learn only about objects but not about the ideas themselves. The "episteme," to which mathematics and philosophy are merely preparatory steps, represents a concept which makes us realize the ultimate realities, the ideas.

Among the ideas, Plato considers the idea of the good as the principal one (a doctrine chiefly expounded in "The Republic"), but while it dominates the other ideas, they participate in it. Today, some of these ideas seem essential, *e.g.*, the ideas of beauty and of truth; others, however, seem much less so, *e.g.*, the ideas of the major virtues like wisdom and temperance and the ideas of mere abstractions like symmetry and proportion. Plato did not clearly solve the problem of connecting ideas with actual things we perceive because in the various "dialogues" he gives different explanations of this connection. However, his general belief seems to be that the actual things participate in the original metaphysical idea, of which they are only a feeble mirror; that they imitate the idea more or less perfectly and that they are mixed with it.

All philosophers after Plato have speculated on the meaning of his approach to the metaphysical

ideas and have put forward their own special analysis. Therefore, we have to distinguish among classical Greek Platonism, Neo-Platonism (*q.v.*), medieval Platonism, and modern idealistic Platonism. Each of these schools and, in fact, almost each individual philosopher, has his own way of explaining the general approach from Plato.

There are some philosophical questions about which we know almost more from individual dialogues of Plato's than from later interpretations. The "Phaedo," for instance, tells absolutely clearly his doctrine of the immortality of the soul, which, in his opinion, exists previous to the body. Everything that we know thus seems to him to be only a partial recollection of the ideas which the soul was able to perceive before it entered the individual body. The individual human body actually hampers the knowledge of truth, which would be perceived much more clearly by the bodiless soul.

Of all the other dialogues, only "The Republic" has to be mentioned because it is less philosophical and more realistic than the others. It deals with problems of education, but at the same time with problems of government and justice. The state is considered superior to the individual and the family, and the end of education is seen to be the preparation of each citizen for the best possible service to the state.

A complete clarification of the philosophical concept of Plato can be accomplished only by analyzing each single dialogue. His approach to some individual questions develops and even changes, but never does his most original and most profound concept. The nucleus of his system, that the ideas exist independently beyond the physical realm, that they are absolute and pure condensations of our abstractions and that the physical world represents only imperfect, partial mirrors of these ideas is maintained throughout all of them.

Platoon (*plā-tōon'*), formerly a body of troops who fired simultaneously. In the U.S. Army, a platoon now generally comprises two sections (four squads), or about 48 men, directed by a first or second lieutenant.

Platt (*plāt*), ORVILLE HITCHCOCK, legislator, born in Washington, Conn., July 19, 1827; died Apr. 21, 1905. He studied at an academy and in 1849 was admitted to the bar. For some time he practiced his profession at Meriden. He was elected to the state senate of Connecticut in 1855, became secretary of state in 1857, and was again elected to the state senate in 1861. For four years he was a member of Congress, beginning in 1865, and was elected U.S. Senator in 1879. He served in the senate about 25 years, and wrote the famous Platt Amendment, which was made a part of the Constitution of Cuba (*q.v.*).

Platt Amendment. See *Cuba*; *Platt*, O.H.

Platt-Deutsch (*plät-doich*), or LOW GERMAN, a German dialect spoken in the lowlands of North Germany. It is popularly called *Low Dutch* by English-speaking people, and is a distinct language that came down to the present time from the Old Saxon. The Flemish and Dutch languages are classed with the Low German, but, since they have a considerable literature and are associated with different political governments, they are usually regarded as distinct languages. They include a number of different dialects, but all of them show a remarkable agreement with the Dutch, German, Flemish, English, and Scandinavian in their system of consonants. Formerly the Low German was spoken in a large region south of the North Sea, particularly before the Reformation, but since then the *High German* has steadily superseded it as the modern classical language, but it is still spoken in the homes of the peasants. A literature of much interest has been written in the Low German; it has especially been enlarged and popularized by Fritz Reuter and Klaus Groth.

Platte (*plät*), a river formed at North Platte, Neb., by the confluence of the North Platte and South Platte Rivers. After a course of about 400 m. toward the east it joins the Missouri at Plattsmouth. Both the North and South Platte Rivers rise in the Rocky Mts., the former having a length of about 800 m. and the latter about 500 m. The channels of these rivers are wide and sandy, and during the melting of the snow on the mountains, in May and June, they are filled with rapidly flowing and sand-colored water; but in the other seasons of the year extensive sand bars appear. Neither of these rivers is navigable. The entire basin of the Platte includes about 300,000 sq. m. Its valley is broad and fertile in the eastern part, but in the foothills and mountains are precipitous bluffs on both sides. They are chiefly of a mixed limestone and sandstone formation.

Plattsburg (*pläts'bürg*), county seat of Clinton County, New York, on Lake Champlain, at the mouth of the Saranac River, 165 m. n. of Albany. It is on the Delaware & Hudson R.R. and is attractive as a summer resort. It is the seat of a state teachers college. Champlain Coll., which was a part of the State Univ. of New York, was located here after World War II but is no longer in operation. Manufactures include wall paper, paper products, and razor blades.

First settled in 1784, Plattsburg was incorporated as a city in 1902. Nearby, off Valcour Island, occurred the first naval battle of the American Revolution, on Oct. 11, 1776. Population, in 1940, 16,351; in 1950, 17,738.

Plattsmouth (*pläts'müth*), county seat of Cass County, Nebraska, on the Missouri River, 21 m. s. of Omaha. It is situated immediately

south of the Platte River, on the Missouri Pacific and the Chicago, Burlington, & Quincy R.R.'s. The place has a large trade in cattle, grain, lumber, and merchandise. It has extensive railroad machine shops. Among the manufactures are dairy products, bread, canned fruits, tobacco products, flour, machinery, clothing, and truck bodies. Plattsmouth was settled in 1853 and incorporated as a city in 1855. Population, 1940, 4,268; in 1950, 4,874.

Platypus (*plät'i-pūs*), an amphibious mammal, a genus of the subclass Monotremata, found only in Tasmania and southeastern Australia. There is only one species, *Ornithorhynchus anatinus*, and it is an egg-laying, nocturnal mammal. The adult is from 12 to 20 in. long and has two toothlike prominences on either side of the jaw. The muzzle is flat and quite large, resembling a duck's bill. It has short, thick fur, dark brown above, lighter below. The short, powerful limbs have webbed feet and each hind limb possesses a spur which secretes a poison. The platypus sleeps and rears its young in deep burrows



Courtesy Australian News & Information Bureau, N. Y.

PLATYPUS

in river banks. It subsists on worms, insects, and crustacea. The female feeds its young on milk which is exuded through pores in the skin.

Plautus (*pló'tūs*), TITUS MACCIUS, Roman comic dramatist, born at Sarsina, in Umbria, of free parents, about 254 B.C.; died in 184. He probably received his education at Rome, where he studied the Latin language and acquired proficiency in Greek literature. It is thought that he became connected with a dramatic company at Rome and that he later engaged in foreign trade, but, after failing in this, returned to Rome. At the age of 30, shortly before the Second Punic War, he composed his first three plays. Their success encouraged him to continue in literary work. From 224 B.C. until his death, he devoted his time entirely to literature.

The authentic plays of Plautus became confused with others which passed under his name, so that tradition varies, some assigning to him as many as 130 plays. The known writings of Plautus have been arranged from a treatise pub-

lished by Varro. These 21 plays we now regard as those of Plautus. His plays portray the life of the middle and lower classes of Rome, and their humor has caused them to remain popular for centuries. Many of his plots and scenes show the influence of the Greek writers, but his original style and phrasing have been highly commended by Cicero and Varro. His influence can be seen in the works of Dryden, Shakespeare, and Addison, and a number of his works have been translated into many modern languages. His 21 plays are: "Amphitruo," "Asinaria," "Aulularia," "Captivi," "Curculio," "Casina," "Cistellaria," "Epidicus," "Bacchides," "Mostellaria," "Menaechmi," "Miles Gloriosus," "Mercator," "Pseudolus," "Poenulus," "Persa," "Rudens," "Stichus," "Trinummus," and "Truculentus." "Vidularia" exists only in a fragmentary condition.

Player Piano (*plā'ēr pī-ān'ō*), a mechanically operated piano. The fundamental idea of the player piano is perhaps 200 years old. Its real development and practical application date back to about 1870, while the important improvements which made the player piano a commercial possibility were developed from 1910 to 1930.

Jacquard of silk loom fame, in 1802, invented the perforated cardboard pattern of the jacquard loom and this in principle is identical to the perforated music rolls of the present day.

About 1868, John McTammany constructed a player piano mechanism that was concealed in the case of the piano and substituted a narrow sheet of perforated flexible paper with winding and rewinding rolls instead of the perforated cardboard pattern of Jacquard. These two inventions made the player piano practical and from that time on it became popular. With the player piano, the player need not be a trained pianist but through a system of controls can regulate the tempo, the phrasing, and the volume of the music cut into the player piano roll. Further development was a reproducing piano. This was an electrically operated player piano which accurately reproduced the playing of the world's finest pianists. This was done by making a record of the actual playing of the pianist, which was then cut into the roll, and in addition all the controls were operated from the player piano roll, so that an exact reproduction of the artist's playing could be obtained.

With the advent of the radio and the increasingly fine reproduction of the phonograph, the demand for player pianos declined until today there are none being manufactured commercially.

Playfair (*plā'fār*), LORD LYON, chemist and statesman, born in Meerut, India, May 21, 1819; died in London, England, May 29, 1898. He was graduated from St. Andrews Univ., Scotland, studied chemistry at the Andersonian Univ., Glasgow, and returned to India to improve his

health. In 1843 he became professor of chemistry at the Manchester Royal Institution, and later was appointed by Sir Robert Peel on the sanitary commission to examine the chief British cities. He had charge of the department of juries at the exhibition of 1851, receiving as a reward a companionship of the Bath, and in 1857 became president of the Chemical Society of London. The following year he was elected to the chair of chemistry in the Univ. of Edinburgh, and in 1868 entered Parliament as a Liberal representing Edinburgh and St. Andrews Univs., holding his seat for 17 years. In 1873 he was made postmaster general. He was raised to the peerage as Baron Playfair of St. Andrews and in 1892 was made a lord-in-waiting. Lord Playfair wrote a number of works on chemistry and educational subjects and edited Liebig's "Chemistry in Its Application to Agriculture and Physiology."

Plays (*plāz*). See *Drama*.

Pleasanton (*plēz'ūn-tūn*), ALFRED, soldier, born in the District of Columbia in 1824; died at Washington, D.C., Feb. 17, 1897. He was graduated from West Point Military Acad. in 1844, served with distinction under Gen. Taylor in the Mexican War, and for bravery in the Battles of Palo Alto and Resaca de la Palma was brevetted first lieutenant. He served in the regular army until the beginning of the Civil War, and in 1862 was commissioned a major of cavalry. When Gen. Lee invaded Maryland, Pleasanton commanded the cavalry that followed his army. Later he took part in engagements at Boonsboro, South Mountain, Antietam, Fredericksburg, and Chancellorsville. At the last-mentioned battle he checked the advance of Stonewall Jackson, thereby saving Hooker's army. Soon after he became major general and took a leading part in the campaign before Gettysburg, for which he was made colonel in the regular army. In 1864 he was transferred to Missouri, where he distinguished himself by compelling the Confederates under Gen. Price to retreat from the state. He became major general in the regular army in 1865, but resigned his commission in 1868. President Grant appointed him collector of internal revenue in the latter year, and later he became president of the Cincinnati & Terre Haute R.R. He was placed on the retired army list in 1888 with the rank of colonel.

Plebeians (*plē-bē'yanz*), or **PLEBS**, one of the two great classes into which the Roman people were divided, the other being the *patricians*. The latter class held all the offices of the government and enjoyed the privilege of governing the affairs of the nation. The plebeians were denied these, and were forbidden to marry patricians. Though the plebeians bore the brunt of fighting, they were denied the right of using the spoils of war. The contest between the two classes for the enjoyment of equal civil rights constitutes

a large part of the civil history of Rome. In 268 B.C. the Hortensian law was finally established, under which the two hostile classes were recognized as one general body of Roman citizens with equal rights. This law provided practical equality in the rights of property. With representation of these classes in the legislative branch of the government, their civil rights remained practically equal; later all distinctions disappeared.

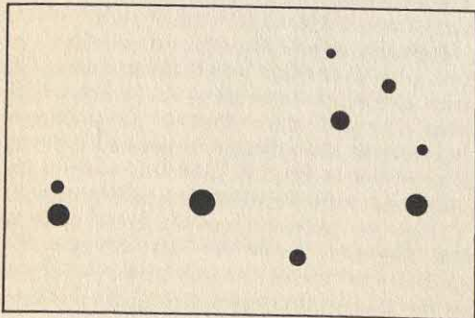
Plebiscite (*plēb'ī-sīt*). See *Election*.

Plehve (*plā've*), VYACHESLAV KONSTANTINOVICH, statesman, born in St. Petersburg, Russia, in 1848; died July 28, 1904. He was descended from a noble but poor family, and with the aid of wealthy friends was able to secure a general education for a business and public career. For some time he was a minor official in the government, but later became imperial counsel at Warsaw. Under Nicholas II he was raised to the dignity of procurator at St. Petersburg and subsequently became assistant minister of the interior. In 1902 he became minister of the interior, serving until the onset of the Revolution of 1904-05. His rigid policies provoked criticism by the Liberal party, and he was assassinated.

Pléiade (*plā-yād'*), a group of French poets of the 16th century. See *Du Bellay*, *Joachim*.

Pleiades (*plē'yā-dēz*), a beautiful cluster of stars in the constellation Taurus, sometimes called the *Seven Sisters*. It contains several hundreds of stars six of which are easily visible to the naked eye, while three more are in reach of exceptionally good eyesight. In Greek mythology the Pleiades are the seven daughters of Atlas and Pleione. They are Celaeno, Electra, Taygeta, Maia, Asterope, Merope, Alcyone, and the parents Atlas and Pleione. The Greeks account for only six of these stars being visible to the naked eye by asserting that Electra left her place that she might behold the ruin of Troy, which city was founded by her son Dardanus. Later they all committed suicide out of grief for the death of their sister and were placed by Zeus as stars on the shoulder of Taurus. All the stars of the cluster travel through space with a common motion.

PLEIADES



Pleistocene Culture (*plīs'tō-sēn kŭl'tŭr*). See *Pre-History*.

Pleura (*plŭ'rā*), a thin, moist membrane that lines the cavities of the chest, forming a covering of the external surface of the lungs. It is in the form of an enclosed sac and within is a fluid called the *serum*, which is secreted to prevent friction. The pleura consists of two chambers. A portion of the outside of one sac is closely attached to one of the lungs and its root and the other portion to the inside of its thoracic wall, while the fluid lubricates the pleural surfaces, permitting the lung portion to move smoothly over the thoracic portion. Besides forming a protection of the lungs, it serves to hold it and other organs of the chest in position.

Pleurisy (*plŭ'rī-sŷ*), in medicine, an inflammation of the pleura, the membranes which line the chest cavity and cover the lungs. This condition occurs usually during the active period of life, being relatively rare in infancy and old age. Although pleurisy may develop following an injury or exposure to cold, it usually occurs as a complication of one of the varieties of pneumonia (*q.v.*) or of tuberculosis (*q.v.*). It may be an acute sudden or a slow chronic process, according to the progress of the underlying infection of the lungs. In acute pleurisy the pleural membranes are reddened and there is slight exudation of lymph (*q.v.*) fluid—the so-called *dry pleurisy*. The process may stop here and heal, or may progress to a second and more prolonged stage with copious effusion of serous fluid—the so-called *wet pleurisy* or *pleurisy with effusion*. The latter disease heals slowly, leaving thickening of the pleural membranes and adhesions between the lung and chest walls. Occasionally when the underlying infection is severe, fluid or pus pockets may form which are drained by inserting a needle into the chest wall over the pocket in order to promote faster healing. The sulfa drugs and penicillin are effective in treating pleurisy the same as they are effective against the underlying lung infection (except tuberculosis). The symptoms of pleurisy include pain in the chest over the affected area, made worse on inspiration; rapid respiration, chills and fever, dry cough, and thirst. The patient often lies on the affected side in an effort to splint the chest to avoid the painful movement of respiration. Firm strapping of the affected side of the chest is useful in relieving the pain, along with other measures carried out by the physician. The condition is not very dangerous or disabling, except in cases where the underlying cause, such as tuberculosis, overcomes the patient.

Pliny the Elder (*plīn'ī*), renowned writer and naturalist, born at Comum, Italy, now called Como, in 23 A.D.; died in the year 79. He was the uncle of Pliny the Younger. Due to the position

of his family, he obtained in Rome the most liberal educational training available in his time. At the age of 23, he became commander of a troop of cavalry stationed in Germany and served for some years under L. Pomponius Secundus, whose biography he later wrote. In 52, he returned to Rome and studied law, and after practicing the legal profession for a short time, he returned to his native town to devote his attention to literary research. Later appointed governor of Spain by Nero, he remained in that country until 71. Soon afterward he returned to Rome, to pursue literary work again, and in 73, he adopted his nephew, Pliny the Younger, whose education he directed.

He is the author of a large number of works, but only one, his "Natural History," has come down to us. At his death he left his nephew various extracts from all the books he had read. Pliny felt that no book was so bad as not to contain some good, and his "Natural History" was compiled in harmony with this theory. Published about 77, it is divided into 37 books, and according to his own account, is a compilation from upward of 2,000 volumes. It covers the whole range of the scientific knowledge of his time, and is one of the chief sources of information concerning the life of the earliest Christian era. He became commander of the Roman fleet, and, in 79, was stationed off Misenum when the eruption of Mt. Vesuvius buried Pompeii and Herculaneum. Eager to witness this phenomenon at close range, he hastened toward the seat of disturbance, but was suffocated in the vapors caused by the eruption. These circumstances of his death are related by the younger Pliny in a letter to the historian Tacitus.

Pliny the Younger, a Roman orator and

PLINY THE YOUNGER

Courtesy Brown Bros., N. Y.



author of the "Epistles," was born at Comum, on the Lake of Como, Italy, in 61 A.D.; died in 115. After the death of his father, C. Caecilius, he was adopted by his uncle, Pliny the Elder. He studied at Rome under Quintilian, whose influence may be seen in his pupil's writing. Extremely cultured, he showed great devotion for literature, and, like his uncle, was noted for industry and perseverance. In 81 A.D., at the age of 18, he made his first appearance as an advocate before the quorum. He was chosen consul in the year 100, and was later made governor of Pontica in 103. After two years' service there, he became curator of the banks and channel of the Tiber.

Pliny's literary fame rests largely upon his panegyrics on Emperor Trajan known as the "Eulogium," and his informal "Epistles." These comprise the only existing works. His "Epistles" were published in nine books with a final volume after his death. As an associate of Tacitus, the two criticized each other's work, and by their intimacy became so linked that they were jointly remembered in people's wills.

Pliocene (*plī'ō-sēn*), in geology, the last epoch of the Tertiary period, so named because the greater part of its fossil shells belong to the recent species. Some writers apply the term post-pliocene to the more recent deposits in which no extinct species of fossil shells are found which are below those that contain relics of man. Only small areas of this period are found in North America, but the formations belonging to this epoch are very extensive in Europe.

Plotinus (*plō-tī-nūs*), Greek philosopher, born in Egypt in 205 A.D.; died in 270. He is perhaps the most important of the Neo-Platonic philosophers (see *Neo-Platonism*) and greatly influenced the philosophy of medieval Christianity. From Egypt he visited Persia and India, where he learned much about the wisdom of the Orient. In 244, he went to Rome and there enjoyed the interest and active help of the Emperor Gallienus, who furthered his plans for founding a new Platonic, Utopian community in Campania. Plotinus's death, however, made the execution of this idea impossible. Among his disciples were Emilius, Aristochius, and the well-known Porphyry, who published his treatise, the six "Enneads."

Plotinus's concept represents a fusion of the Platonic concept of the existence of ideas (see *Plato*) with Oriental concepts of emanation. The "One" emanates all existence. The inferior is always emanated from the superior. The first emanation is the mind (*nous*), the second the soul, the last matter. Only through the endeavor for knowledge is it possible for man, who is partially spirit, partially matter, to approach the higher region. Knowledge itself develops from the perception of sensations to mathematics, logic, and dialectics to the really pure knowledge. This last

knowledge recognizes the oneness of human and divine existence and oneness of the ideas and their worldly reflections in the realm of the mind. Few are able to identify themselves in a mystical way with the One. Plotinus's ideas about beauty, justice, transmigration, and even demons grow out of this general concept.

If man is to be able to conceive of his soul as a part of the world soul, he has first to deny reality. This idea, as was only natural, was taken over by Christian philosophers. St. Augustine (*q.v.*), Johannes Scotus (*q.v.*), and others were influenced by Plotinus very strongly, as were also medieval Jewish thinkers, German mystics and, much later, the philosophers of German idealism, like Fichte and Schelling, and also to a certain degree Schopenhauer and Schleiermacher (*q.v.*).

Plover (*plūv'ēr*), a class of birds frequenting the shore and inland waters of America and Europe. Many of the species are well known, differing in size and color. The *common plover* has long wings, the points usually projecting beyond the tail. It is speckled above and black or dark brown below. The *gray plover* is native to the Northern Hemisphere and the *speckled plover* is found largely in Europe, where it is known locally as the *golden plover*, a name applied because of its coloring of yellow above. The American *golden plover* has yellowish feathers above and smoky-gray below. It feeds principally on insects or the larva found in marshes, and appears to be very fond of grasshoppers. Other American species include the *green plover*, the *killdeer plover*, and the *stilt plover*. Birds classed with the plovers are found in all the temperate and warmer regions. They fly with rapidity and run swiftly, some species pretending to be injured, with the design of protecting their nest and young from an enemy.

WATER STONE PLOVER

Courtesy N. Y. Zoological Society



The *field plover* is a notable example of this class and is found in many regions of America in cultivated fields, where it feeds on seeds, insects, and berries.

The *ring plover* is a familiar bird in Eastern Canada, especially on the shore of Cumberland Bay. It is about 8 in. long, nests among the pebbles of the sea, and searches for food near the receding waves. The legs are white, the crown and collar are black, and the general color is white with yellow markings. Another Canadian species, the *piping plover*, ranges southward from Newfoundland. Most of the plovers molt twice a year and the males and females have a very similar appearance. The nests of all species are built on the ground. Some species are valued for their flesh, and their eggs are eaten in many countries. They are mostly migratory birds, passing to the higher latitudes in the spring.

Plow (*plou*), an implement used by farmers and others for turning over, furrowing, or breaking up the soil. It is drawn by human, animal, or mechanical power. Those designed for ordinary field work are constructed with the view of cutting off longitudinal slices of earth and turning them over so an entirely new surface becomes exposed to the action of the air. Plows of this kind usually have a cutter that cuts off the weeds and stubble so all substances above the surface may be wholly turned under, thus providing the soil with fertilizing substances and exposing a surface well adapted to cultivation and for receiving the seed of a crop to be sown or planted. Plows are mentioned very early in history.

Metal-tipped plows are mentioned in the Old Testament; the instrument was widely known in ancient times, reaching the pinnacle of its development in Rome. Thereafter, practically no improvements were made until recent times. With the dawn of scientific agriculture in the early 18th century, new plows were developed to permit more efficient breakage of the soil. Progress, however, was slow until this century, when the application of motor-driven tractors to agricultural uses enabled farm machinery designers to utilize the new sources of power. Tractor plows are now used on most modern farms in America and elsewhere.

Plum (*plūm*), a class of fruit trees belonging to the same genus as the apricot, almond, peach, and cherry. This fruit is cultivated very extensively, especially in the Temperate Zones. Many species have been described. They range from the small products of cold regions to the large and luscious kinds produced extensively in the Temperate and Tropical Zones. Plums are native to many countries and were found extensively distributed in America at the time of its discovery, though since then other species have been acclimated, and the American trees have been

improved more or less by propagation. Among the common species of cultivated plums are the Chickasaw, beach, damson, Damascus, blackthorn, green gage, Cashmere, cherry, and St. Julien. These differ greatly in size, taste, color, and form, and are alike valuable for different purposes. *Prunes* are made by drying certain kinds of plums, such as the German and Turkish prunes. Others are eaten fresh, preserved, or used in making syrup, vinegar, and alcohol. Plum jellies, jams, and syrups are delicious. Plum wine is valuable for coloring, purifying, refining, and mellowing spirits and is made from prunes. The plum tree yields a hard and fine-grained wood which is well adapted for carvings.

Plummet (*plūm'ēt*), or PLUMB LINE, an instrument used to fix vertical lines, or lines in the direction of terrestrial gravities. It is of very ancient origin and is referred to in Isaiah 28:17. This instrument consists of a weight, generally of lead, hanging to a string. A square is usually set in a vertical position by a plumb line, the other limb of the square being horizontal, and in this way it is possible to determine both vertical and horizontal lines. In surveying and astronomical instruments the plummet is sometimes used in fixing and regulating their position, but the *spirit level* is employed more generally. Surveyors usually employ the spirit level to regulate the horizontal position of the compass, and a plummet is used to indicate where a stake or marker is to be fixed in the surface of the ground.

Pluperfect (*plōō'pēr-jēkt*), in grammar, the verb tense which expresses an action completed in the past, e.g., he had written.

Plush (*plūsh*), the name of a fabric which is similar to velvet, but different from the latter in having a longer pile or shag. Many varieties are manufactured and sold in the market. Some grades are all worsted, while others are worsted with a mohair pile, and still others are of cotton with a silk pile. Mohair-and-worsted plush is employed in making upholstered furniture and the former enters largely into wearing apparel, such as caps and cloaks. Dresses and hats worn by women and several kinds of hats for men are made of plush with silk pile. France, Germany, and England produce the largest quantities of plush fabrics.

Plutarch (*plū'tārk*), biographer and moralist, born in Chaeronea, Greece, about 46 A.D.; died about 117. He studied philosophy at Athens, and later moved to Rome where he learned the Latin language, came in contact with noted Roman scholars and statesmen, and lectured on philosophy. In the latter part of his life he resided at Chaeronea, where he filled the office of magistrate and was a priest to Apollo.

He is the author of "Opera Moralia," essays on historical, physical, and moral subjects, but his

fame rests upon the work "Parallel Lives," treating of 44 illustrious men. The biographies are arranged in pairs as follows:

1. Eumenes and Sertorius.
2. Cimon and Lucullus.
3. Lysander and Sulla.
4. Demosthenes and Cicero.
5. Agis and Cleomenes.
6. Pelopidas and Marcellus.
7. Phocion and Cato the Younger.
8. Aristides and Cato the Elder.
9. Pericles and Fabius Maximus.
10. Nicias and Crassus.
11. Dion and Brutus.
12. Timoleon and Æmilius Paulus.
13. Philopoemen and Titus Flaminus.
14. Themistocles and Camillus.
15. Alexander and Caesar.
16. Agesilaus and Pompey.
17. Pyrrhus and Marius.
18. Solon and Valerius Publicola.
19. Demetrius and Antonius.
20. Alcibiades and Coriolanus.
21. Theseus and Romulus.
22. Lycurgus and Numa.

The first mentioned in each of the pairs is a Greek. Besides these biographies, Plutarch wrote the lives of Artaxerxes Mnemon, Galba, Aratus, Otho, Tiberius, and Caius Gracchus. It is said that Napoleon was profoundly interested in reading Plutarch.

Pluto (*plōō'tō*), in Greek legend, the surname of Hades, the third son of Cronos and Rhea, and brother of Zeus and Poseidon. The Greeks regarded him ruler of the infernal regions, which were afterward known as Hades, being so named from Pluto. In the time of Homer, Hades was the name of a person instead of a place, as it was afterward applied, and the people of his time had no conception of two distinct realms for the departed, but both the good and bad were thought to live together. In later history Hades became the name of a place, and it was thought to consist of two distinct regions, the realm of the good being known as *Elysium* and that of the wicked as *Tartarus*. This modification of the conception of the realm of the departed also modified the station assigned Pluto, who became the ruler of Tartarus, but he was regarded as the guardian of treasures below the earth, and it was thought that he caused an abundance of fruit to spring from the soil. The name Pluto is from *plutein*, meaning to be rich. In later times the Romans adopted the Greek notions with regard to a future state, and began to worship Pluto in place of Dis Pater, a name derived by them from *dives*, meaning rich.

Pluto, the most remote planet so far discovered. Its period of revolution around the sun lasts 248 of our years. Its average distance is 39.5 times that of the earth to the sun, but on account of the elliptic shape of the orbit the distance varies from 49 to 30 times. It was found

Jan. 23, 1930, after a painstaking photographic search by C. W. Tombaugh at the Flagstaff (Arizona) Observatory. Only large telescopes show it, since it is as faint as a 15th magnitude star. Latest research estimates its diameter at *ca.* 3,200 m.

Plutocracy (*plōō-tōk'ra-sy*), a political system in which government is controlled by the wealthy class (see *Plutus*). The name is also loosely used, usually derogatorily, for the wealthier classes collectively.

Plutonium (*plōō-tōn'i-ūm*). See *Atomic Bomb*; *Uranium*.

Plutus (*plōō'tūs*), the Greek god of riches, son of the fertility goddess Demeter and a mortal named Iasion, hence originally a god of bountiful harvests. Zeus blinded him so that all might receive his gifts without discrimination. He is represented in art as coming to men slowly but departing from men on wings. Plutus was made the subject of a comedy by Aristophanes.

Pluviometer (*plōō-vi-ōm'e-tēr*), or RAIN GAUGE, an instrument for measuring the amount of rain which falls on any given surface. Various instruments have been devised to obtain fairly accurate measurements of rainfall. A gauge in wide use is the U.S. Weather Bureau "weighing rain and snow gauge." Rain and snow are collected in a receiving bucket which is balanced on springs. A drum, driven by clockwork, automatically and continuously records the precipitation. Another device widely used by the Weather Bureau is the "8-in. gauge." This consists of a funnel-shaped receiver, 8 in. in diameter at its wider end, with a measuring tube, 2.53 in. in diameter and 20 in. long, fitted onto the small end of the funnel. The receiver and measuring tube fit into an overflow can 24 in. high. The catch of rain, which is magnified ten times by this instrument, is measured by a stick graduated in proportion to this magnification factor. In the case of snow, the catch is collected directly in the overflow can, then melted and poured into the measuring tube where it is measured in the same manner as rain. Gauges have been developed which indicate the duration of each shower as well as the rate at which the water falls.

PLYMOUTH ROCK MONUMENT



Pluviôse (*plū-vyōz*), the name, meaning approximately "rainy," given to the fifth month of the year in the Revolutionary Calendar adopted in 1793 by the National Convention of the First French Republic. It began, according to the number of the year in which it fell, on Jan 20, 21, or 22.

Plymouth (*plīm'ūth*), a port of entry in Massachusetts, county seat of Plymouth County, 42 m. s.e. of Boston. It is on Plymouth Bay, an inlet of Massachusetts Bay, and on the New York, New Haven & Hartford R.R. The town is famous as the landing place of the Pilgrim Fathers (Dec. 21, 1620), who founded the first permanent English settlement in New England. The major point of interest is Plymouth Rock, a boulder onto which the Pilgrims are supposed to have stepped when they went ashore from the *Mayflower*. Another is the Forefathers Monument, a granite memorial 81 ft. high. Pilgrim Hall, a museum erected in 1824 by the Pilgrim Society, contains an excellent collection of paintings relating to the history of the Pilgrims and of articles brought from England on the *Mayflower*. Plymouth has the largest rope-manufacturing plant in the world. Other manufactures include metal products, window curtains, women's clothing, and worsted fabrics. Cranberry cultivation and fishing are important industries. Population, 1950, 13,608.

Plymouth, a borough in Luzerne County, Pennsylvania, on the Susquehanna River, 20 m. s.w. of Scranton. It is on the Delaware, Lackawanna & Western and the Delaware & Hudson R.R.'s. Its principal industry is the mining and shipping of anthracite coal, but it also has manufactures of hosiery and clothing. Plymouth was settled in 1768, in territory claimed by both Connecticut and Pennsylvania until 1797, and incorporated in 1866. Population, 1940, 15,507; in 1950, 13,021.

Plymouth, an English county borough, seaport, and naval base in the county of Devonshire, between the estuaries of the rivers Tamar and Plym, on the north shore of Plymouth Sound, *ca.* 200 m. s.w. of London.

REPRODUCTIONS OF EARLY HOUSES



Plymouth is an ancient city, and was mentioned in the 11th-century Domesday Book where it is called "Sutone," i.e., south town. In the 12th century it was called "a mene thing as an inhabitation of fishers." In 1439 it received a charter of incorporation, the first in England's history to be bestowed by Act of Parliament, and assumed the name of the King's Town of Plymothe. Its history is closely bound up with the rise of Britain's naval power. The great sailors Hawkins and Drake were mayors of the city, and it contributed a larger number of ships and sailors to the fleet that conquered the Spanish Armada than any other English town. Its position on the southwest coast made it important in England's commerce with the New World; it was from Plymouth that the *Mayflower* sailed in 1620, and that Capt. Cook set forth on his first voyage to Australia in 1768.

The present city has grown from the fusion of three towns: Plymouth, East Stonehouse, and Devonport, which were amalgamated in 1914. It is second only to Portsmouth (*q.v.*) as a naval base, and its population is overwhelmingly dependent for employment upon naval and, to a lesser extent, military and Royal Air Force activities; in 1937, 40 per cent of the population were engaged in the two occupational groups, public administration and defense, and shipbuilding and marine engineering, as compared with 11 per cent for the country as a whole. It serves as shopping center for the surrounding country, and has minor industries including clothing factories, printing, general engineering, and quarrying. There is also some commercial use of the port. The city is on the main Great Western Ry. line connecting London and Southwest England.

Plymouth suffered severely from German bombing during World War II, especially during the air raids of March and April 1941, which wiped out whole areas. The buildings destroyed (some of great historic interest) included 40 churches, the civic buildings, libraries, theaters, and main shopping streets, as well as thousands of homes. "A Plan for Plymouth," prepared (1943) with the aid of Sir Patrick Abercrombie, Britain's most famous town-planner, lays down lines for reconstruction. This looks to the planning of the surrounding countryside to provide the city with a green belt. It proposes that "historic Plymouth," the oldest part of the town, which includes the Barbican Quay, be preserved as an enclosed precinct; and that a new City Center extend from famous Plymouth Hoe overlooking the sound to the north railway station, with well-planned shopping and amusement centers in between. An important feature of the plan is the provision for new industries, to lessen the city's dependence on the naval base; in particular, it suggests that Plymouth exploit its position in the

midst of some of England's loveliest scenery to attract tourist traffic. Population, *ca.* 200,000.

Plymouth Colony (*kōl'ō-nī*). See *Pilgrim Fathers*.

Plymouth Rock (*rōk*), a granite boulder on Massachusetts Bay, celebrated because of the landing of the Pilgrim Fathers on Dec. 21, 1620. It is supposed that Mary Chilton and John Alden were the first Europeans to set foot upon the rock. A large piece was broken from the rock in the early period of the colony, and this was taken by 20 yoke of oxen to the center of the city of Plymouth, where it was surrounded by an iron railing, but it was returned to its original position at Hedges' Wharf in 1880.

Plymouth Sound (*sound*), on the north shore of which the city of Plymouth, England, is situated, is a considerable inlet of the Atlantic Ocean. The county of Cornwall borders it on the w., that of Devonshire on the e. Two rivers flow into it: on the northwest the Tamar, through its wide estuary the Hamoaze; and on the east the Plym, whose estuary is called the Cattewater. On the northern, or city, shore of the sound, the high limestone plateau of Plymouth Hoe rises above streets and dockyards to command a magnificent view out to sea—as far, on clear days, as the Eddystone Lighthouse 15 m. away. The Hoe, according to an old legend, was the battleground of the Celtic hero Corrinacus and the Cornish giant Gogmagog. In the harbor is Drake's Island, now a fortress but once a prison in whose dungeons famous captives languished.

Over 2 m. out in the sound is the Breakwater, which shelters the waters of the harbor. This is a limestone barrier, built by Rennie in 1812 and considerably enlarged since; it is 3,000 ft. long and cost between \$7,000,000 and \$8,000,000 (£1,500,000) to build.

Plymouth Sound has much natural beauty, and was the scene of many historic sea battles, especially during England's wars with France.

Plywood (*plī'wōd*). See *Wood*.

Pneumatic Conveying (*nū-māt'ik kōn-vā'ing*), a system of transmission employing the effects of suction and propulsion by air in a manner similar to that of pneumatic dispatch (*q.v.*). Here, however, no carriers are used and the objects to be transported are directly sucked or propelled by compressed air through flexible or rigid tubes. Pneumatic conveying is possible and profitable only where the distances involved are short (from ship to shore, from truck to storage tank), and where the load consists of a great mass of small, even-sized objects, such as grains, ashes, or coals.

Pneumatic Dispatch (*dīs-pāch*), a system of transmitting letters, bills, checks, etc., through metal tubes by means of air pressure and/or suction. The first mention of pneumatic dispatch



Courtesy Monopoly State Review

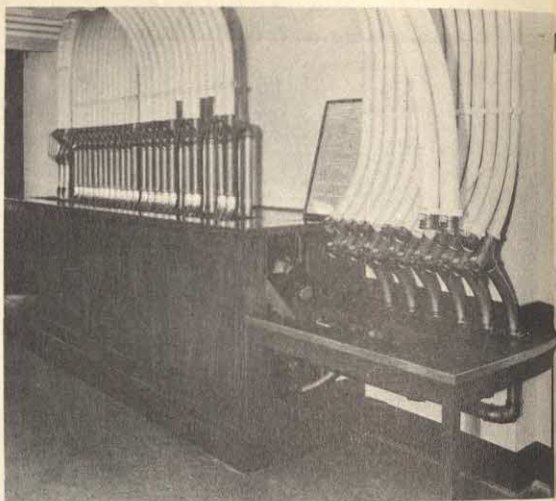
PNEUMATIC CONVEYING

seems to occur in a paper presented in 1667 by Denis Papin (who had worked together with Boyles and Huygens on vacuum pumps), before the Royal Society in London.

In 1854 Josiah Latimer Clark took out a patent for the first workable system which was subsequently installed in London. The first installation had lead tubes of $1\frac{1}{2}$ in. diameter, was 220 yds. long and worked by suction, one-way only. The introduction of air pressure later on made it possible to return the carriers through the same tube.

Several systems of pneumatic dispatch are used currently: (1) the original *English system*, where a central office receives and dispatches messages through incoming (suction) and outgoing (pressure) tubes. Smaller stations handle their traffic with single two-way tubes; (2) the *Continental system*, used in Paris, where carriers go in one direction only, the stations being arranged in rings. In some systems carriers are dispatched in carrier trains at regular intervals whereby on each station the messages destined to this station are taken out and new messages together with the rest of the carrier train are dispatched. Air pressure is applied only when needed; (3) the *Siemens system*, used in Berlin, and the *Batcheller system*, used in New York, both of which maintain a continuous flow of air in the tubes. Through special receiving sluices and dispatching valves it is possible to maintain uninterrupted traffic without interfering with the main flow of air or with other carriers in transit. Tubes are also arranged in closed circuits and pressure and suction are simultaneously applied from opposing ends. The carriers in all systems are tubular oblong receptacles of metal or plastics with suitable buffers on both ends.

The use of pneumatic tubes has spread from



Courtesy Lamson Corp., Syracuse, N. Y.

PNEUMATIC DISPATCH TUBES

postoffices, banks, and exchanges where it originated to hospitals, warehouses, department stores, hotels, newspapers, restaurants, and even factories—where at present not only papers but also small tools and machine parts may be transmitted by tubes. Pneumatic tubes provide a cheap and quick medium of communication, as the power used in house systems is very small and can even be generated by hand, though it is today, of course, nearly always generated by electricity. The average speed of a carrier is approximately 1000 yds. per minute. The smallest tubes in common use have a diameter of $1\frac{1}{2}$ in., the largest tubes, one of 8 in., capable of conveying a carrier weighing 8 lbs.

Pneumatics (*nû-măt'iks*), the branch of science which treats of gases, either at rest or in motion. Gases differ from liquids in that their molecules possess greater freedom of motion, but, like the latter, possess the following properties: They transmit pressure equally in all directions; the downward, upward, and lateral pressures at any point are equal; and bodies weighed in air or gas lose a weight equal to the weight of the air or any gas they displace. The repulsive tendency in gases is very marked, which may be seen by placing a small quantity of gas into an empty vessel, when it will expand until the entire vessel is filled. The science of pneumatics includes an investigation of the property of gases, such as their density, weight, pressure, elasticity, condensation, rarefaction, equilibrium, and diffusion. It investigates the instruments and machines that depend upon the pressure and elasticity of air for their actions, such as the barometer, balloon, and air pump (*q.v.*). See also *Gas*.

Pneumatic Tire (*tîr*), a tube of rubber or rubber fabric. It is mounted on the rim of wheels used

by automobiles, bicycles, airplanes, etc. Except for a limited number of certain industrial vehicles, tires consist today of a rubber fabric casing or "shoe" filled with compressed air, which may be replaced through a one-way stop valve. The weight of the vehicle rests on the column of compressed air.

The outer casing, or tire proper, is manufactured by joining a strip of rubberized cord fabric to two steel hoops that form the beads with which the tire is mounted on the wheel rim. Over this first (inner) layer of rubberized cord fabric, other layers or "plies" are laid, reinforced by a "breaker strip" under the tread, and "chafers" or chafing strips over the beads. A heavy layer of compounded rubber tops the other layers to form the tread ply into which, at the subsequent vulcanization, the characteristic anti-skid design is molded.

The first patent for a pneumatic tire was taken out by Robert William Thompson, of Scotland, in 1845. His invention did not become popular, however, until 1888, when John Boyd Dunlop, also of Scotland but practicing as a veterinary surgeon in Belfast, Ireland, patented his version of a pneumatic tire. Dunlop's tire showed many features of the pneumatic tire now in use, such as a separate air container protected by an outer casing and a reinforced tread. Dunlop's invention gave great impetus to cycling (*q.v.*); and the automobile (*q.v.*) could never have achieved its predominant role without the development of such a tire. The Michelin Co., of France, was the first to adapt the pneumatic tire to motor-car use in 1895; and such tires for airplanes were first brought out by the Dunlop Tire and Rubber Corp. in 1910.

Pneumatic Tools, a class of tools operated by compressed air. Such tools are principally applied by hand, and the mechanism which receives the impulse to power from the compressed air is in the handle or housing. Two types of pneumatic tools are in extensive use, known as *percussion* and as *rotary* tools. The first type includes those used for drilling, riveting, chipping, caulking, ramming, and hammering. They are used in working metal, cutting stone, and carving wood. An air compressor located at a convenient central point conducts the compressed air through a suitable connection, which includes a flexible hose of some length so as to permit the workmen to handle the tool with facility. Percussion tools strike from 1,500 to 20,000 blows per minute, depending upon the manner of construction and handling for the particular use to which they are applied. A valve in the handle permits the operator to control both the speed and the force of the tool.

Rotary tools are used for drilling and boring in wood and for various purposes in metalwork,

such as boring cylinders, screwing nuts on bolts, expanding tubes, grinding joints of steam pipes, and boring cylinders and valve seats. The drills are made in a large number of sizes and forms, and so may be adjusted or replaced with facility as the character and progress of the work to be done may require. The mechanism works with an air pressure of from 60 to 100 lb., but in some larger tools the pressure is up to 125 lb. per sq. in. Pneumatic tools are used extensively in larger industrial establishments, especially in England, France, Germany, Italy, Canada, and the U.S.

Pneumectomy (*nû-mô-nêk'tô-mî*), a surgical procedure of removal of a portion of a lung, usually a single lobe, affected with chronic or incurable disease such as tumors or severe injuries.

Pneumonia (*nû-mô'nî-q*), a commonly occurring infectious disease of the lungs. *Lobar pneumonia* is most frequently caused by the pneumococcus bacterium (*Diplococcus pneumoniae*), and more rarely by the hemolytic streptococcus, the staphylococcus, and Friedlander's bacillus. It is called *lobar pneumonia* because it is characterized anatomically and pathologically by inflammation and consolidation of one or more lobes of the lung, usually more or less completely incapacitating that part from performing its normal respiratory function. There are 32 recognized different types (cultural and microscopic differences) of the common causative organism, the pneumococcus, most prevalent of which are types I, II, III, V, VII, and VIII. Some individuals carry non-virulent forms of the pneumococcus in their throats and respiratory passages which may become active and cause acute pneumonia when contracted by another person.

The disease occurs at all ages, more frequently in adults increasing with age, and rarely in children of less than one year. Among the predisposing conditions to pneumonia are poor ventilation, overcrowding, undernourishment, fatigue, and exposure to dampness and cold, with frequently an immediately antecedent history of sore throat, cold, grippe, or bronchitis. One usually contracts this disease by inhaling the droplets exhaled by the coughing, sneezing, or forceful breathing of a person infected with the pneumococcus. One to two days after the initial infection there is an acute onset of illness with severe chills and fever, cough, blood-tinged or rusty colored expectoration, labored and rapid breathing, with pain in the chest on the affected side, due to a usually accompanying pleurisy (*q.v.*), dark concentrated urine, and cyanosis (dusky or bluish color) of the skin, lips, and nails, due to insufficient oxygenation of the blood by the air in the affected lung. The temperature reaches and remains at 103° to 105° F., and the pulse is proportionately rapid. Sometimes the patient is delirious due to the fever and toxic effects of the infection.

PNEUMONOKONIOSIS

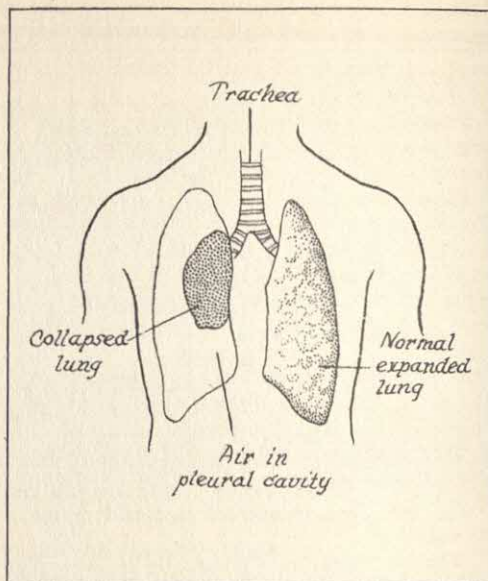
The acute course usually lasts from 7 to 10 or 12 days, ending in "crisis" (sudden drop in temperature and improvement of the patient's condition) or by "lysis" (gradual drop in temperature and accompanying improvement) as the consolidated lung begins to clear. Adequate treatment includes strict rest in bed and good nursing care, high fluid intake, high caloric and easily digestible diet, oxygen tent—especially in case of labored breathing and cyanosis, and the specific use of the sulfa drugs and/or penicillin to combat the infection itself. A specific pneumococcal antiserum is sometimes used in refractory cases, or in cases with severe complications. Before the advent of the above-mentioned drugs, mortality from pneumococcus pneumonia averaged from 25 to 40 per cent, but since then the mortality is considerably less than 10 per cent.

Bronchopneumonia, similar to lobar pneumonia, in symptoms and course, is caused by the same organisms and also by the influenza bacillus, and is treated in a similar manner. It frequently occurs as a complication of some other condition such as cold, gripe, measles, or influenza, and is perhaps the most common complication of chronic severe debilitating diseases, such as typhoid fever or brucellosis. Anatomically it consists of small patches of inflammation of the small bronchial tubes and surrounding tissue. The disease commonly occurs in children before the age of 10 and in adults beyond the age of 50 years.

Atypical or virus pneumonia is a type of pneumonia frequently seen but diagnosed only in recent years, the cause of which is thought to be a specific filtrable virus. The condition is usually not serious and the course is mild with slight to moderate fever and mild cough. Diagnosis is usually made by x-ray.

Pneumonokoniosis (*nū-mō-nō-kō-nī-ō'sis*). See *Occupational Diseases*.

Pneumothorax (*nū-mō-thō'răks*), a medical term, meaning an accumulation of gas or air in the pleural (lung) cavity of the chest allowing more or less collapse of the lung on the affected side. Pneumothorax may occur in case of an external wound of the chest causing an opening into the pleural cavity through the chest wall, or by perforation of the lung by an inhaled object, by the burrowing action of a lung abscess, or by spontaneous rupture of surface air cells of the lung. Such cases of *spontaneous pneumothorax* are usually sudden in onset with severe pain on the affected side and rapidly increasing difficulty in breathing, inasmuch as the respiratory system is now leaking air. The normal respiratory movements of the combined actions of chest wall movements, raising and lowering of the diaphragm, and elasticity of the lungs become relatively ineffective as the normal pressure between the chest wall and the lung surface changes to positive from



PNEUMOTHORAX

the normal slightly negative pressure necessary to keep the lungs expanded. In any case of sudden and persistent pain in the chest medical attention should be obtained, and an open wound of the chest should be plugged immediately. *Artificial pneumothorax* is a slow introduction of air or an inert gas such as nitrogen into the pleural cavity through a needle inserted between the ribs, for the purpose of partially or completely collapsing a diseased lung so that it may rest and heal. This is done especially in cases of tuberculosis of the lungs, and is a prolonged process, i.e., repeated air injections must be given in order to keep the lung collapsed, because the injected air is slowly absorbed and dissipated. When the diseased lung has sufficiently healed, the air is gradually withdrawn, and the lung expands and resumes its normal function.

Po (*pō*), a river of Europe, the largest in Italy. It rises in the Alps, near the boundary line between Italy and France, at an altitude of 6,000 ft., and drains the large plain of northern Italy lying between the Alps and the Apennines. The length is 417 m. and its basin includes 27,750 sq. m. It enters the Adriatic Sea by a large delta, extending inland above Ferrara, a distance of 60 m., and its width at the sea is about 58 m. The Po is remarkable for its width and the large volume of water carried from the mountains to the sea. Its extensive navigation facilities make it an important route. Among the tributaries are the Adda, the Ticino, the Mincio, and the Trebbia. Turin is the most important city on its banks, but there are others that enjoy a large commercial trade. In April 1945, the Allies broke through the valley of the Po, thus reaching the strategic industrial cities of northern Italy and by this victory vir-

tually bringing to an end the Italian phase of World War II.

Poaching (*pōch'ing*), in English law, entry upon land belonging to another person for the purpose of killing or stealing game.

Pocahontas (*pō-ka-hōn'tas*), daughter of Powhatan, a distinguished Indian chief, born in 1595; died in Gravesend, England, in 1617. Her early life was spent among the Indians in Virginia. In 1608, according to "The Generall Historie of Virginia" (1624), by Capt. John Smith (*q.v.*), she saved the captain's life. Smith had been taken prisoner while on an exploring expedition and, according to his account, was about to be put to death when she prevailed upon her father to spare his life. Historians are in disagreement concerning the truth of the story. In 1612 Pocahontas was captured by the English and held as a hostage. The following year she was converted to Christianity and christened Rebecca. She married John Rolfe, an Englishman, in 1614, and two years later accompanied him to England. There she was entertained by the bishop of London and received at court as an American princess. She was the object of much interest during her six-month stay. She died while preparing to return to Virginia. Pocahontas was the mother of Thomas Rolfe, from whom many illustrious Virginia families descended.

POCAHONTAS



Pocatello (*pō-ka-tē'lō*), a city in Idaho, seat of Bannock County. The second-largest city in the state, it is located on the Portneuf River, *ca.* 230 m. s.e. of Boise. It is served by the Union Pacific R.R. Surrounded by fertile agricultural country, it is an industrial and transportation center, the site of cheese plants, creameries, and feed and flour mills. Other manufactured products include phosphate fertilizers and petroleum. Pocatello is the site of Idaho State Coll. It was settled in 1882 and incorporated as a city *ca.* 1893. Population, 1940, 18,133; in 1950, 26,131.

Pochard (*pō'chērd*), a sea duck (genus *Nyroca ferina*) of the Old World. The head of the male is red, its breast is black, and its back is white with narrow black stripes. The female, of duller plumage, is called the *dunbird*. The pochard is related to the canvasback and the redhead of the U.S.

Pocket Battleship (*pōk'ēt bāt'l-ship*), name popularly applied to a type of World War II warship of relatively small displacement (*ca.* 12,000 tons), built by Germany after the treaty of Versailles limited her naval tonnage. It was a dangerous foe, even to vessels of higher rank, because of its heavy armament (20 guns, up to 11 in.), long-range projectiles, and speed. A noted pocket battleship was the *Admiral Graf Spee*, which was scuttled in 1939 near Montevideo, Uruguay, after a battle with three British cruisers. The Japanese built similar vessels, but the type did not come into universal use.

Podiatry (*pō-dī'a-trī*), until recently called *chiropody*, the latter term having originated with D. Low in his publication "*Chiropodologia*" (1785). Originally the *chiropodist* (now *podiatrist*) treated ailments of the hands and the feet, and especially deformities and disturbances of the toes. With the growth and development of podiatry as a science and a profession with prescribed courses of study leading to a degree, specialization ensued; now the licensed podiatrist may practice minor surgery on the feet, diagnose and treat foot ailments, perform palliative and mechanical treatment of foot deformities, and prescribe corrective measures for foot abnormalities. He may not use anaesthetics other than local; operate on the bones, ligaments, tendons, or muscles of the foot; or treat communicable or constitutional diseases of the feet. The various states of the U.S. differ in their laws regarding the educational requirements, licensing, and status of this profession.

Poe (*pō*), EDGAR ALLAN, American lyric poet, short-story writer, editor, and critic, born in Boston, Mass., Feb. 19, 1809; died in Baltimore, Md., Oct. 7, 1849. Poe, whose parents were actors, was left an orphan in 1811 and was adopted by John Allan, of Richmond, Va., whose name was added as Poe's middle name.



EDGAR ALLAN POE

From 1815 until 1820, while his foster-parents were in England, Poe was sent to Manor House School, near London. After further education in Richmond, Poe entered the Univ. of Virginia. At the end of a single term, devoted too largely to drinking and gambling, Poe was withdrawn from the university by Allan and left behind him debts which his foster-father refused to pay. His pathological reaction to alcohol handicapped Poe throughout his life and contributed to his early death.

In 1827 Poe enlisted in the U.S. Army. In 1829, when Poe had achieved the grade of sergeant major, Allan arranged for Poe's honorable discharge and secured an appointment to the U.S. Military Acad. for him in 1830. In 1831 Poe was dismissed after court-martial for neglect of his military duties and was finally estranged from his foster-father. After his dismissal from West Point, Poe was befriended by his aunt, Mrs. Maria Clemm, whose daughter, Virginia Clemm, he married in 1836, when she was but 13 years old. Poe's wife died in 1847. Throughout his life, both before and after his marriage, Poe was peculiarly dependent upon his aunt, her mother.

Although Poe had published (anonymously) "Tamerlane and Other Poems" in 1827 and "Al Aaraaf, Tamerlane and Minor Poems" in 1829, his career as a professional man of letters began after his dismissal from West Point. In 1833 his story "MS. Found in a Bottle" won a prize of \$100 as the best story submitted in a contest sponsored by the Baltimore *Saturday Visitor*. In 1835 he became assistant editor of the *Southern Literary Messenger*, a Richmond magazine. Thereafter he held editorial posts with the *Gentleman's Magazine* and *Graham's Magazine* in Philadelphia, the *Evening Mirror* and the *Broadway Journal* in New York.

Poe's short stories, which are for the most

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part tales of mystery and horror, and which like his poems have sometimes been described as "morbid," have important historical significance in the development of the short story as a literary form. They are striking examples of the most conscious artistry and have served as models of craftsmanship for many later short-story writers. They are sufficiently divorced from reality, however, to be not of the highest rank. Among the best known of his stories are "The Fall of the House of Usher," "The Tell-Tale Heart," and "The Murders in the Rue Morgue."

Poe's poems are also remarkable rather for technical skill in versification than for the insight which makes poets great. The best known of his poems, "The Raven," "Annabel Lee," "Ulalume," and "The Bells," illustrate as well as any others their mechanical contrivances. Poe himself observed that in "The Raven" he had written a poem that would live, and he was right, but it does not stand among the really great poems of the world.

Poe's essay on "The Philosophy of Composition," published in *Graham's Magazine* in 1846, is the most interesting of his critical writings. In it he gives a detailed account of his own method in composing "The Raven," which had appeared the year before and which had been extremely popular.

Poet and Peasant (*pō'ēt and pēz'ant*), an operetta by the Austrian Franz von Suppé (1819-95). Von Suppé, together with the composers Karl Milöcker (1842-99) and Karl Zeller (1842-98), established the classic Viennese operetta which was to reach its climax in the works of Johann Strauss the younger (1825-99).

Poet Laureate (*lō'rē-āt*). See *Laureate, Poet*.

Poetry (*pō'ēt-rī*) is imaginative literature, literature which makes its appeal primarily to the imagination and to the emotions. As imaginative literature, it presents an imitation of reality, not a transcription of it.

Although poetry is often thought of as literature written in metrical form, the identification of poetry and verse is inexact and misleading. Our greatest "poems" are written in verse because the emotional content characteristic of them is best expressed in verse, but Homer's "Iliad" is an epic poem whether we read it in the original Greek verse, in an English verse translation, or in a literal prose translation. Shakespeare's introduction of prose passages into his plays does not make him less a dramatic poet. Henry Fielding, writing "The History of Tom Jones," a prose narrative and perhaps the greatest novel to be written in English, thought of himself as writing a "comic epic." Stephen Vincent Benét describes his "John Brown's Body" as "a novel in verse." Furthermore, the distinction between prose and verse is itself not always clear (e.g., the "prose

poems" of Lafcadio Hearn, the "prose" psalms of the English Bible, and the cadenced but non-metrical verse of Walt Whitman). It is better therefore to distinguish poetic from other literature in terms of the purpose of the writer and in terms of more important matters of form than the arrangement of syllables into a metrical pattern.

Poetry differs from history, then, because it deals with imaginary agents and events. Aristotle and many of his followers have pointed out that because it is not restricted to matters of fact, poetry is capable of an even higher truth than history. Free from the actual, the poet can deal exclusively with the probable. This is the sense in which fact is indeed stranger than fiction. In the world of fact, for example, accidents happen. Men are run down by motorcars, without apparent reason. The use of accident in a narrative poem lessens its credibility, however, since it is improbable that any particular person will be the victim of an accident at any particular time. The reader of a newspaper will believe what he will not believe in fiction. The poet, in other words, is concerned not with accidental events but with causally connected events—with events which are related causally to one another and to the characters of the agents who take part in them, and he is concerned with the general, not the particular, significance of such events.

Poetry differs from philosophical, scientific, and other expository or didactic treatises in making its appeal primarily to or through the emotions rather than the intellect. Although its ultimate concern, like that of philosophy, is for general truth, poetry shares with history the advantage of dealing with particulars, of being concrete and specific. It is for these reasons, among others, that some critics, especially in the Renaissance, have found poetry more effective than expository essays as a means of presenting a view of the world. Milton, for one, observes in his "Areopagitica" that Spenser for his use of the example of Guyon (in his "Faerie Queene") is a better teacher than Scotus or Aquinas.

Critics have divided poetry into "schools" upon the basis of the interests and attitudes of the poets. Thus we have romantic and classical poets, romantic, realistic, and naturalistic fiction. Goethe, Wordsworth, and Shelley, for example, are classified as "romantic" poets because of the highly emotional content of their writings and because of their rebellion against conventional forms and techniques and conventional ideas. Racine, Dryden, and Pope, on the other hand, are called "classical" or "neo-classical" poets because of the intellectual restraint characteristic of them and because of their acceptance of principles of composition derived from the study of classical forms and classical ideas. Like other literary classifica-

tions, these designations are inexact. Moreover, they do not apply to poets of the very highest rank. The works of the very greatest poets include both "romantic" and "classical" elements and are above literary controversy.

Poetry is also divided into types. Although these types are not always clearly distinguished, and although some poems defy classification, poetry is usually thought of as including three main types: the epic, the dramatic, and the lyric.

Epic poetry consists of imaginative literature in which action is recounted by a narrator. The great classical epics are the "Iliad" and "Odyssey" of Homer and the "Aeneid" of Virgil. Of modern formal epics only Milton's "Paradise Lost" ranks with these. Epic poetry also includes a great deal of narrative literature of all ages, some of which is called "romance." Outstanding examples of medieval "epics" are "Beowulf," in Old English, the "Song of Roland," in French, and the "Nibelungenlied" in German. The Icelandic Eddas and Sagas are also epic literature. Outstanding examples of Renaissance epics are Ariosto's "Orlando Furioso" and Spenser's "Faerie Queene." Since epic poetry in the broadest sense includes all imaginative literature in narrative form, it is possible to give only a few examples.

Dramatic poetry consists of imaginative literature in which action is presented on a stage by means of dialogue or which is written as if to be presented on a stage. Drama is usually divided into tragedy and comedy. Tragedy concerns itself with actions in which misfortune is brought upon an extraordinary person in part because of some flaw in his character. The action is so presented as to arouse in the audience the emotions of pity and fear. Comedy, on the other hand, usually concerns itself with more ordinary human types and is not concerned primarily with the misfortunes of the characters or presents them satirically as deserved misfortunes, so as to amuse the audience rather than to arouse the emotions of pity and fear. It is a convenient (but inexact) rule of thumb to say that a comedy ends happily and a tragedy in misfortune. The great tragic dramatists include Aeschylus, Sophocles, Shakespeare, and Ibsen. The great comic dramatists include Aristophanes, Shakespeare, Molière, and Bernard Shaw.

Lyric poetry consists of imaginative literature in which personal, emotional experiences are given expression in song or songlike forms. Lyric poetry differs from epic and dramatic poetry in not being narrative. Representative lyric types are psalms, hymns, and popular songs; sonnets, odes, and elegies. Lyric poetry has been written by most modern and many ancient poets. A list of great lyric poets would include Sappho, Pindar, Virgil, Petrarch, Ronsard, Goethe, and Shelley.

Although many people think only of lyric poetry as poetry, it is significant that the greatest poets of the world have been primarily epic or dramatic poets; e.g., Homer, Virgil, Dante, Milton, Aeschylus, Sophocles, Shakespeare.

Poilu (*pwà-lü'*), from the French *poil* meaning hair, popular name for a recruit in the French army. During World War I, one who had served in the trenches was called a poilu, probably because of his growth of beard, since there was no time for shaving.

Poincaré (*pwān-kā-rā'*), JULES HENRI, mathematician and physicist, born in Nancy, France, in 1854; died in Paris, July 18, 1912. In 1886 he was made professor of mathematical physics and calculus of probabilities in the Univ. of Paris. His contributions to mathematical physics were manifold, including his studies on Fuchsian functions, differential equations, and astronomical theories.



RAYMOND POINCARÉ

Dedicating a war memorial at Chaillon, France, 1930

Poincaré, RAYMOND, statesman, born at Bar-le-Duc, France, March 20, 1860; died in Paris, Oct. 15, 1934. He was a successful lawyer and entered the chamber of deputies in 1887. Beginning in 1893, he was a member of several cabinets. He was a senator (1903-12), premier (1912-13), and president of France (1913-20). Poincaré furthered the entente with Britain and Russia, and his nationalism and tenacity greatly influenced the outcome of World War I. During his later terms as premier (1922-24 and 1926-29), he insisted on his country's financial claims against a defeated Germany and ordered the occupation of the Ruhr (1923). In his last cabinet, he concentrated on the stabilization of the franc. He became a member of the French Acad. in 1909.

Poinsettia (*poin-sēt'i-q*), a Mexican shrub deriving its name from J. R. Poinsett, American minister to Mexico (around 1826), who brought

it to America for cultivation. It is well known for its large red leaves and blooms around the end of December.

Point Barrow (*point bār'ô*). See *Barrow*.

Pointer (*poi'n'tēr*), one of a group of sporting dogs remarkable for their habit of pointing with the head to indicate the presence of game. The habit is instinctive, since it may be noted in puppies, but it can be improved materially by training. The pointer was developed in the 17th century in Europe and England. It was crossed with the foxhound and greatly resembles that breed. A well-trained pointer stops immediately on scenting game and remains perfectly still, indicating the direction of the game. See also *Dog*.

Pointillism (*pwān'ti-liz'm*), from French *point*, meaning dot, the school of French painting founded by Georges Seurat (1859-91) and Paul Signac (1863-1935), successors of the impressionists, and sometimes known as neoimpressionists, from whom they are distinguished in that they dissolved the surface of things to an even greater extent. They subdivided the surface into a mosaiclike network of small dots of color, which, from a certain distance, gives the impression of an entity.

Poison (*poi'z'n*), any substance that may cause injury or death by chemical action on the local tissues of the body of the average healthy person. Commonly, acute poisoning arises from substances taken by mouth, from inhalation (breathing) of toxic gases or dusts, from skin contact with corrosive or absorptive materials, or by hypodermic injection. Poisons are often taken accidentally, especially by children; by overdosage of medicine or individual hypersensitivity to some common medicine or even some foods; by swallowing substances left about carelessly, such as acids, alkalis, old medicines, disinfectants, insecticides, roach or rat poisons, paint or paint solvents, cleaning fluids, polishes, etc. In any case of suspected poisoning, *call a physician at once*, and give first aid if possible.

In giving first aid (*q.v.*), try to locate the cause of the poisoning. See if there is an empty bottle, vial, pillbox, or other container nearby. If the poison container is labeled, read the label carefully. Labels may contain instructions for giving an antidote for that substance. If the label does not contain instructions, then turn to the alphabetical list which follows for specific first-aid measures.

Often the first aider must decide quickly for himself the nature of the poison. Burns about the lips, mouth, or tongue may indicate an acid or alkali poison (see acids and alkalis in table following). A yellow burn indicates nitric acid; black, sulfuric acid; white, carbolic acid or lye. If the pupils of the eyes are much dilated, suspect

POISONS

[illegible]

Where universe antidote emetics, or stimulants are referred to, see introductory text.

POISONS

CALL PHYSICIAN AT ONCE IN ALL CASES

POISON	SYMPTOMS	FIRST AID ¹	POISON	SYMPTOMS	FIRST AID ¹
Boric acid and borates (May be in certain washing compounds, wood preservatives)	Vomiting. Diarrhea. Pain in abdomen. Muscle spasms. Shock.	Give universal antidote or tablespoonful of milk of magnesia in much water. Give mustard emetic.	Chlorates (Bromates, nitrates)	Nausea. Vomiting. Headache. Abdominal pain. Delirium. Coma.	Universal antidote. Mustard emetic. Egg white in water. Spirits of ammonia.
Bromine (And bromine gas)	Great thirst. If inhaled as gas: pain and irritation in throat and lungs. If taken internally: pain in mouth and stomach.	Universal antidote. Mustard emetic. Large quantities of water. Strong coffee. Fresh air; let victim inhale If spirits of ammonia in water; milk of magnesia; mustard emetic.	Chloroform (See Ether) Cocaine	Chlorine gas Chlorine (See Benzene hexachloride) Chlorine (Bromine, chlorinated lime, chlorinate water, Javelle water)	Fresh air. Artificial respiration if needed. Spirits of ammonia to inhale. White of egg in water, milk. If swallowed: mustard emetic, coffee, and spirits of ammonia.
Cadmium salts (See Copper salts)	Nausea. Faintness. Headache. Pain in abdomen. Tremors. Weakness.	Universal antidote or charcoal and one tablespoonful of milk of magnesia in water.	Codaine (See Morphine) Copper salts (Also zinc salts, bluestone, cadmium salts, blue vitriol)	Difficult breathing. Tightness in chest.	Fresh air. Let victim inhale spirits of ammonia. Give egg white in water.
Caffeine	Restlessness. Giddiness.	Give mustard emetic.	Corrosive sublimate (See Mercury compounds) Creosote, cresols (See Phenols) Croton oil (<i>Oilum Tigli</i>)	Stimulation, then depression. Hiccups. Sweating. Dry throat. Pupils of eye dilated. Vomiting.	Universal antidote or strong tea. Mustard emetic. Spirits of ammonia.
Calcium arsenate (See Arsenic)	Odor of camphor on breath. Pain in stomach. Vomiting. Weakness.	Universal antidote or charcoal. Mustard emetic or salt emetic. White of eggs.	Cyanides (Acid hydrocyanic, prussic acid, bitter almond oil, cherry laurel water)	Metallic taste. Nausea. Vomiting. Purging. Delirium. Convulsions.	Universal antidote. Milk of magnesia. Mustard emetic. White of egg in water. Milk.
Cannabis (Hashish, marijuana)	Exhalation. Sense of time prolonged. Hallucinations. Delirium. Dilated pupils of eyes.	Strong hot tea. Mustard emetic. Large quantities of water. Black coffee.	DDT (See Benzene hexachloride) 2,4-D (2,4-dichlorophenoxyacetic acid and its salts and esters, contained in some weed killers and herbicides)	Stomach pains. Violent purging. Exhaustion. Collapse.	Universal antidote. Mustard emetic. Large quantities of water. Egg white in water. Milk. If any nitric acid can be obtained, break it and hold it under victim's nose. Try artificial respiration. If conscious give two to three tablespoonfuls of hydrogen peroxide (3%) solution, and salt emetic.
Cantharides (Cantharadin, Spanish fly)	Burning pain in mouth and stomach. Swelling of tongue. Severe colic. Bloody diarrhea. Burning pain in back. Collapse. Coma.	Artificial respiration. Give no oil! Give egg white in water.	Digitalis (Foxglove, digitalin, scopolin, squill, straphanthin) Ergot compounds	Death occurs in a very few minutes in most cases.	Universal antidote or charcoal. Mustard emetic.
Carbolic acid (See Phenol)	Inflamed throat. Heaviness and pain in head. Ringing in ears. Weakness. Failure of respiration. Coma.	Artificial respiration. Fresh air. Cold water on face. Spirits of ammonia. Heat applied to hands and feet and legs. Strong coffee.	Ether (Chloroform, nitrous oxide, laughing gas)		
Carbon disulfide (Used in some paint and varnish removers, rubber cement, vermin killers, solvent for oils)	Giddiness. Headache. Flushed skin. Sore throat. Dilated pupils of eyes. Stupor.	Give two tablespoonfuls of mineral oil. Salt emetic. Spirits of ammonia, or tea, or coffee.			
Carbon monoxide gas Carbon tetrachloride (Some nonflammable cleaning fluids)	Dizziness. Nausea. Fainting. If swallowed: drowsiness; confusion; unconsciousness.	Treat as for carbon dioxide. If inhaled only: fresh air; let victim inhale spirits of ammonia. If swallowed: mustard emetic; spirits of ammonia			
Chloral hydrate (Choralamide, "Mickey Finn," "knockout drops")	Nausea. Vomiting. Tired feeling. Drowsiness.	Universal antidote or strong tea. Mustard emetic. Strong tea or coffee or spirits of ammonia.			

¹Where universal antidote, emetics, or stimulants are referred to, see introductory text.

POISONS

CALL PHYSICIAN AT ONCE IN ALL CASES

POISON

SYMPTOMS

FIRST AID!

<p>Fluorides (Ammonium, flu- oride, sodium fluoride, roach- poison)</p> <p>Vomiting. Cramps in abdomen. Weak pulse. Convulsions.</p> <p>Formaldehyde (In certain disinfectants, deodorants, fingertides, and larva- cides)</p> <p>If breathed: highly irritating to nose, throat, eyes, and skin. If swallowed: vomiting; burning pains in stomach; collapse.</p> <p>If swallowed, toxic illness. Stomach ache.</p> <p>Gasoline (See Naphtha)</p> <p>Hair waving preparations (Thioglycolic acid, tho- glycol)</p> <p>Heroin (See Morphine)</p> <p>Hexylresorcinol (In some antiseptics)</p> <p>Hydrogen peroxide</p> <p>Hydrogen sulfide (Alkali sulfides, sewer gas, arsine, phosphine)</p> <p>Iodine</p> <p>Iodoform</p> <p>Kerosene (See Naphtha)</p> <p>Laudanum (See Morphine)</p> <p>Lead (And compounds of lead, tetraethyl lead, lead paints, lead arsenate, lead acetate, litharge)</p> <p>Line</p>	<p>Milk of magnesia. Mustard emetic. White of egg in water. Chalk in water. Large amounts of milk. Fresh air. Artificial respiration. Wash eyes with large quantities of water. If swallowed: give spirits of ammonia; salt emetic; white of egg in water; milk.</p> <p>Universal antidote or charcoal. Salt emetic.</p> <p>Charcoal or universal antidote. Mustard emetic. Egg white in water. Mustard emetic. Egg white in water.</p> <p>Fresh air. Artificial respiration if needed. Rub hands and feet. Give flour and water. Egg white and water. Starch and water in large quantities. Milk.</p> <p>Universal antidote or milk of magnesia. Mustard emetic. Keep victim warm and quiet.</p> <p>Whites of several raw eggs in water. Mustard emetic. Follow with more egg whites and water. Give spirits of ammonia. Tablespoonful of Epsom salts in water.</p> <p>Give lemon, orange, or grapefruit juice in water. Follow this with egg white in water and give milk to drink.</p> <p>Give milk of magnesia. Mustard emetic. Whites of several raw eggs. Milk.</p> <p>Universal antidote or strong hot tea and charcoal. Mustard emetic. Spirits of ammonia. Strong coffee. Keep victim awake, if possible.</p>	<p>Fluorides (Ammonium, flu- oride, sodium fluoride, roach- poison)</p> <p>If swallowed: mustard emetic; coffee or tea; keep warm; artificial respiration, if necessary. If inhaled: omit the mustard emetic.</p> <p>Formaldehyde (In certain disinfectants, deodorants, fingertides, and larva- cides)</p> <p>If breathed: highly irritating to nose, throat, eyes, and skin. If swallowed: vomiting; burning pains in stomach; collapse.</p> <p>If swallowed, toxic illness. Stomach ache.</p> <p>Gasoline (See Naphtha)</p> <p>Hair waving preparations (Thioglycolic acid, tho- glycol)</p> <p>Heroin (See Morphine)</p> <p>Hexylresorcinol (In some antiseptics)</p> <p>Hydrogen peroxide</p> <p>Hydrogen sulfide (Alkali sulfides, sewer gas, arsine, phosphine)</p> <p>Iodine</p> <p>Iodoform</p> <p>Kerosene (See Naphtha)</p> <p>Laudanum (See Morphine)</p> <p>Lead (And compounds of lead, tetraethyl lead, lead paints, lead arsenate, lead acetate, litharge)</p> <p>Line</p>	<p>Methoxychlor (See Benzene hexachloride)</p> <p>If swallowed: burning in mouth and stomach; headache; nausea; vomit- ing; tremors; dizziness; coma. If inhaled: giddiness; flushed face; dilated pupils; labored breathing.</p> <p>Restlessness. Twitchings. Depression. Convulsions. Urine dark brown to black.</p> <p>Coma. Excitement. Confusion. Restlessness. Muscular twitches. Weakness. Convulsions. Prostration. Disturbed vision. Collapse.</p> <p>Flushed face. Heartbeat first violent, then dimin- ished. Severe throbbing headache. Dizziness. Tremors. Dilated pupils.</p> <p>Severe pain in throat and stomach. Intense thirst. Muscular weakness. Vomiting. Twitching of facial muscles. (Coma. Headache. Dilated pupils. Collapse. Poison may result from inhalation, swallowing, or through absorption through the skin. Headache. Blurred vision. Weakness. Nausea. Colic. Diarrhea.</p> <p>Paris green (See Arsenic)</p> <p>Petroleum (See Naphtha)</p> <p>Phenacetin (See Acetanilid)</p> <p>Phenobarbital (See Barbiturates)</p> <p>Phenols (Carbolic acid, cre- osote, cresols, guaiacol, some fungicides and anti- septics)</p> <p>Burning pain from mouth to stomach. Whitish burns on mouth and lips. Weakness. Headache. Nausea. Collapse. Coma.</p> <p>Phosphorus (Yellow, white phosphorus, some rat poi- sons, matches)</p> <p>Cardiolite taste and odor. Nausea. Burning pains in stomach.</p>	<p>Methoxychlor (See Benzene hexachloride)</p> <p>If swallowed: mustard emetic; coffee or tea; keep warm; artificial respiration, if necessary. If inhaled: omit the mustard emetic.</p> <p>Formaldehyde (In certain disinfectants, deodorants, fingertides, and larva- cides)</p> <p>If breathed: highly irritating to nose, throat, eyes, and skin. If swallowed: give spirits of ammonia; salt emetic; white of egg in water; milk.</p> <p>Universal antidote or charcoal. Salt emetic.</p> <p>Charcoal or universal antidote. Mustard emetic. Egg white in water. Mustard emetic. Egg white in water.</p> <p>Fresh air. Artificial respiration if needed. Rub hands and feet. Give flour and water. Egg white and water. Starch and water in large quantities. Milk.</p> <p>Universal antidote or milk of magnesia. Mustard emetic. Keep victim warm and quiet.</p> <p>Whites of several raw eggs in water. Mustard emetic. Follow with more egg whites and water. Give spirits of ammonia. Tablespoonful of Epsom salts in water.</p> <p>Give lemon, orange, or grapefruit juice in water. Follow this with egg white in water and give milk to drink.</p> <p>Give milk of magnesia. Mustard emetic. Whites of several raw eggs. Milk.</p> <p>Universal antidote or strong hot tea and charcoal. Mustard emetic. Spirits of ammonia. Strong coffee. Keep victim awake, if possible.</p>	<p>Fluorides (Ammonium, flu- oride, sodium fluoride, roach- poison)</p> <p>If swallowed: mustard emetic; coffee or tea; keep warm; artificial respiration, if necessary. If inhaled: omit the mustard emetic.</p> <p>Formaldehyde (In certain disinfectants, deodorants, fingertides, and larva- cides)</p> <p>If breathed: highly irritating to nose, throat, eyes, and skin. If swallowed: give spirits of ammonia; salt emetic; white of egg in water; milk.</p> <p>Universal antidote or charcoal. Salt emetic.</p> <p>Charcoal or universal antidote. Mustard emetic. Egg white in water. Mustard emetic. Egg white in water.</p> <p>Fresh air. Artificial respiration if needed. Rub hands and feet. Give flour and water. Egg white and water. Starch and water in large quantities. Milk.</p> <p>Universal antidote or milk of magnesia. Mustard emetic. Keep victim warm and quiet.</p> <p>Whites of several raw eggs in water. Mustard emetic. Follow with more egg whites and water. Give spirits of ammonia. Tablespoonful of Epsom salts in water.</p> <p>Give lemon, orange, or grapefruit juice in water. Follow this with egg white in water and give milk to drink.</p> <p>Give milk of magnesia. Mustard emetic. Whites of several raw eggs. Milk.</p> <p>Universal antidote or strong hot tea and charcoal. Mustard emetic. Spirits of ammonia. Strong coffee. Keep victim awake, if possible.</p>	<p>Fluorides (Ammonium, flu- oride, sodium fluoride, roach- poison)</p> <p>If swallowed: mustard emetic; coffee or tea; keep warm; artificial respiration, if necessary. If inhaled: omit the mustard emetic.</p> <p>Formaldehyde (In certain disinfectants, deodorants, fingertides, and larva- cides)</p> <p>If breathed: highly irritating to nose, throat, eyes, and skin. If swallowed: give spirits of ammonia; salt emetic; white of egg in water; milk.</p> <p>Universal antidote or charcoal. Salt emetic.</p> <p>Charcoal or universal antidote. Mustard emetic. Egg white in water. Mustard emetic. Egg white in water.</p> <p>Fresh air. Artificial respiration if needed. Rub hands and feet. Give flour and water. Egg white and water. Starch and water in large quantities. Milk.</p> <p>Universal antidote or milk of magnesia. Mustard emetic. Keep victim warm and quiet.</p> <p>Whites of several raw eggs in water. Mustard emetic. Follow with more egg whites and water. Give spirits of ammonia. Tablespoonful of Epsom salts in water.</p> <p>Give lemon, orange, or grapefruit juice in water. Follow this with egg white in water and give milk to drink.</p> <p>Give milk of magnesia. Mustard emetic. Whites of several raw eggs. Milk.</p> <p>Universal antidote or strong hot tea and charcoal. Mustard emetic. Spirits of ammonia. Strong coffee. Keep victim awake, if possible.</p>
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Where universal antidote, emetics, or stimulants are referred to, see introductory text.

POISONS

CALL PHYSICIAN AT ONCE IN ALL CASES

POISON	SYMPTOMS	FIRST AID ¹	POISON	SYMPTOMS	FIRST AID ¹
Potash (See Alkalies)			Sulfur dioxide.	Sneezing, coughing, choking, bronchial irritation.	Fresh air. Give spirits of ammonia loth to inhale in water to drink. Hot tea or coffee. Artificial respiration, if necessary.
Potassium cyanide (See Cyanides)				Coma.	
Potassium hydroxide (See Alkalies)			Sulfuric acid (See Acids)		
Potassium nitrate (See Chlorates)			Tartar emetic (See Antimony)		
Procaine and local anesthetics	Slow heart beat. Slow respiration. Paralysis of breathing mechanism.	Universal antidote. Mustard emetic. Spirits of ammonia. If inhaled: fresh air. If swallowed: salt emetic.	Thallium salts (In some depilatories and as rat poison)	Pains in muscles. Twitchings. Vomiting. Neuritis. Diarrhea. Delirium. Convulsions.	Salt emetic. Lukewarm tea or coffee or spirits of ammonia.
Pyrethrum (In some fly sprays and insecticides)	Paralytic effect.		Tobacco (See Nicotine)		
Rat poison (See ANTU, Arsenic, Phosphorus, Strychnine, Thallium)			Toxaphene (See Benzene hexachloride)	Characteristic odor.	Mustard emetic. Give Epsom salts, 1 tablespoonful in glass of water.
Salicylates (Aspirin, oil of wintergreen, salicylic acid, Salol)	Vomiting. Headache. Deafness. Perspiration.	Bicarbonate of soda, half-teaspoonful in glass of water. Salt emetic. Give spirits of ammonia.	Turpentine oil	Giddiness. Excitement. Intoxication. Stomach and throat irritation.	Large amounts of water. White of egg in water. Spirits of ammonia. Black coffee.
Sewer gas (See Hydrogen sulfide)	Pallor. Sometimes air hunger.				
Silver compounds	Pain in throat and stomach. Stained patches on lips, first white, then black.	Salt emetic. Tea.	Veratrine (See Aconite)	Delirium. Collapse. Coma.	
Strychnine (Found in some rat poisons)	Nausea. Vomiting. Collapse. Excitement. Stiff neck. Painful convulsions. Exhaustion.	Universal antidote or strong tea. Salt emetic, but not during convulsions. Keep victim in dark room, lying down.	Vernonia (See Barbiturates)		
			Wintergreen oil (See Salicylates)		
			Wood alcohol (See Alcohol, Methyl)		
			Zinc salts (See Copper salts)		

¹Where universal antidote, emetics, or stimulants are referred to, see introductory text.

POISON IVY

the belladonna group of drugs; if contracted or pinpoint size, suspect the morphine drugs.

General rules for handling poisoning cases consist of (a) giving an antidote; (b) causing the victim to vomit (except in cases where strong acids or alkalis have been taken); and (c) keeping the victim lying down.

To cause vomiting, thrust fingers or a feather deep into victim's mouth and tickle back of throat, or give an emetic. Two commonly available emetics are:

Mustard emetic: Mix two teaspoonfuls of powdered mustard in a cup of warm water.

Salt emetic: Mix a teaspoonful of table salt in a glass of warm water.

If the victim is already vomiting when found, do not give an emetic, but give him large quantities of lukewarm water to drink. In an emergency, use:

Soap emetic: A mild soap and water solution, made with toilet or laundry soap. Do not use synthetic detergents.

Stimulants: Where stimulants are indicated, a teaspoonful or less of aromatic spirits of ammonia may be given in half a glassful of water. Strong hot tea or coffee are excellent stimulants.

Soothing drinks: When the victim's stomach is greatly irritated or burned, soothing drinks may be indicated. These may be flour mixed with water or gruels made with oatmeal, farina, or barley. In some cases, give milk, olive oil, cream, melted butter, salad oil, or mineral oil; give only olive oil in the case of phenol (carbolic acid) poisoning.

"Universal antidote": A mixture of two parts of activated charcoal, one part of magnesium oxide, and one part of tannic acid has been recommended in certain cases or where the cause of poisoning is unknown. Two or three tablespoonfuls of this should be mixed with one half glassful of lukewarm water.

As soon as the doctor arrives, tell him exactly what has been done by way of first aid.

Poison Ivy (r'vé), the common name applied chiefly to two species of *Rhus*, the genus which includes the shrubby sumacs. The two species, *Rhus radicans* and *Rhus Toxicodendron*, are widely distributed over the U.S. They are also known as poison oak, mercury, etc. The plants may grow as trailing vines, in swamps or in dry places, or, sometimes, with stems several inches thick, may climb high up on large trees. The leaves are divided into three separate leaflets; rather pale green in summer, they are brightly colored in the fall. The vines bear clusters of whitish or greenish berries.

A related plant, *Rhus Vernix*, is the species commonly known as the poison sumac. A coarse shrub or small tree, 5-10 ft. tall, it has gray smooth bark and smooth whitish branchlets. The

POISONOUS PLANTS

leaves are formed of 7-13 leaflets, egg-shaped and pointed, staggered along the leaf stem. The fruit is whitish or drab, and globular. The foliage is particularly attractive in the fall. Foliage, flowers, and fruit are somewhat waxy, and all are dangerous. See *Poisonous Plants*.

Poisonous Plants (*poi'z'n-ús plānts*), plants which contain poisons. There is no sharp line between "poisonous" and "nonpoisonous" plants; substances harmful to some persons are harmless to others, and "harmful" itself is rather hard to define. Various plants yield substances which in certain amounts are used in medicine, while in other amounts they may cause death; one is foxglove, from which a substance is obtained for treating heart troubles. Peyote, a species of cactus, is used to produce hallucination, which seems to have no ill effects but certainly interferes with normal function. Nicotine, found in tobacco, is also a poison.

Poisonous plants may act locally or systemically, by contact or when swallowed. Poison ivy, poison oak, and poison sumac (see *Poison Ivy*) form oils which cause blistering of the skin accompanied by intense itching. Many kinds of pollen cause allergies. There are many records of deaths of children who nibbled leaves or roots of water hemlock. Many plants have poisonous berries, among them the black nightshade. A number of plants, including jack-in-the-pulpit, contain poisons which are destroyed by cooking. Extremely poisonous plants are used by natives of South America to compound curare, which they smear on their arrows. Africans use poisonous plants in their religious ordeals and to determine guilt. Among the most deadly plants are certain mushrooms. Some of these, including one called the destroying angel, are fatal even if only a very small portion is eaten; the poison is not affected by cooking, and no antidote is known.

Poitiers (*pwä-tyä'*), formerly spelled *POETIERS*, a city in western France, capital of Vienne department, on the Clain River. Located ca. 180 m. s.w. of Paris, Poitiers has been a trading city for centuries; it is a modern railroad hub. Architecturally it is interesting for its medieval remains, particularly of the 11th and 12th centuries. Among these are the Cathedral of St. Pierre and the Church of St. Hilaire-le-Grand. The seat of a Roman Catholic archbishopric, the city has a noted university, founded in the early 1430's. The history of Poitiers begins with the Pictavi, a Gaulish tribe. The Romans occupied the area, calling the city Limonum, and there are traces of a Roman amphitheater and baths in the vicinity. Poitiers was Christianized in the 4th century. Near the city the Visigoths, under Alaric II, were defeated in 507 by the Franks, under Clovis. Here, too, Charles Martel defeated the Saracens in 732, and on Sept. 19, 1356, Edward the Black



Courtesy The Bettmann Archive, N.Y.

THE BATTLE OF POITIERS, 1356

Prince defeated John II of France. Part of Aquitaine, it was the capital of the counts of Poitou until 1790. Poitiers was damaged in World War II. Population, 1954, 52,633.

Pokeweed (*pōk'wēd*), a perennial plant native to North America, occurring in moist woods and clearings and along fences. It has large, smooth leaves, small, greenish flowers in spikes, and crimson berries. All parts are poisonous. Young shoots, however, are eaten as greens; they should be thoroughly cooked and the first water discarded. From the large branching roots, certain drugs are obtained; and leaves and berries have been used to make a remedy for rheumatism. The plant is introduced in Europe, and the berries have been used in Portugal for coloring wine.

Poland (*pō'land*), a Communist state of north Central Europe, bounded by Germany on the w., Czechoslovakia on the s., the U.S.S.R. on the e. and n.e., and the Baltic Sea on the n.

DESCRIPTION: Geographically, the country may be divided into several distinct areas, parallel

POLAND

zones running east-west, with the land gradually rising from north to south. One of these is Pomerania, bordering on the Baltic Sea, with the major ports of Gdąnsk and Szczecin (Stettin). This coastal area has sandy beaches, marshes, and peat bogs. Parallel to the coast there is a belt of lakes and wooded hills. The soil is not particularly productive, although agriculture is the principal occupation of the region. Fishing predominates on the coast and in the lake belt, and stock breeding is carried on in the uplands. The people are mostly small landowners, thrifty and hardworking, and the level of education is relatively high.

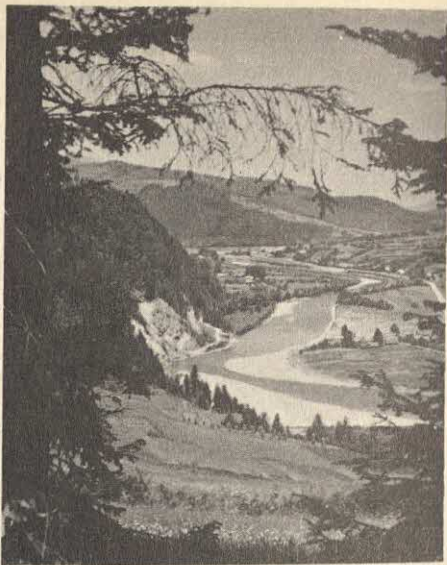
The eastern extension of the great Polish plain, the basin of the Vistula and its tributaries, has sandy, barren, and unproductive soil. The large cities are Warsaw, Lodz, and Białystok, which are all important industrial centers, and Częstochowa, which is famous for its shrine. The area's industrial activity has caused the formation of a large laboring class, quite different from the rural population in language, costume, and manners.

Great Poland is separated from this section by the region of the Masurian Lakes, a part of which send their waters to the Warta and the other part to the Noteć. The main cities are Poznań, Toruń, and Bydgoszcz. Thickly settled, as is all of western and central Poland, the land is only moderately fertile, but it has been improved by cultivation. As in Pomerania and Silesia, German influence is plainly visible in the architecture of the towns and in higher economic development and living standards.

Little Poland, or *Malopolska*, represents the old cultural center of Poland. Its chief city, Kraków (Cracow), was capital of the Polish kingdom for centuries. A new steel-manufacturing city, Nowa Huta, lies just southeast of Cracow. A few miles away lie the salt mines of Wieliczka, reputed to be the oldest in the world. The peasants of Malopolska are small landowners who produce primarily for their own use. The educational level of the area is comparatively high.

Silesia is a mountainous region, most densely populated. Although an infertile land, it is rich in coal, and it is highly industrialized. Chief cities are Wrocław (Breslau) and Katowice. The working people of this region cling firmly to their Polish folk traditions, although foreign influences have often made themselves felt.

In the *Carpathian Mts. area*, the Carpathian ridge, of which the Tatras are a towering part, forms the southeastern boundary of Poland. In the eastern section of the range, the average altitude is about 7,800 ft., and several summits exceed 8,500 ft. The mountaineers of the Carpathians are renowned for their varied handicrafts. They are not agriculturists, but they raise



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DUNAJEC RIVER IN SOUTHERN POLAND

superior cattle on their rich, highland pastures.

POPULATION AND AREA: Poland has an area of 120,355 sq. m. and, according to a Polish government estimate of May 1957, a population of 28,534,000. It is about 20 per cent smaller in territory and in population than it was in 1939, and both its eastern and western frontiers have been moved westward. The eastern frontier, which follows the so-called Curzon Line of 1919 (stretching from near the Lithuanian border in the north to near the border of Czechoslovakia in the south), was recognized by Great Britain, the U.S., and the U.S.S.R. at the Yalta Conference in February 1945. The western frontier, the Oder-Neisse line (stretching from the junctions of the two rivers near Frankfurt-on-the-Oder to the Baltic Sea), has been recognized by only the Communist nations, including East Germany.

In 1945 the U.S.S.R. acquired the eastern provinces of Poland, 69,866 sq. m. of territory, with a population of about 12,000,000, including 5,000,000 Ukrainians, 1,500,000 White Russians, and 1,200,000 Jews. At the same time, the U.S.S.R. granted to Poland 39,986 sq. m. of former German territory, comprising a population of ca. 6,500,000 Poles and ca. 2,000,000 Germans. This territory includes Prussian Silesia, two-thirds of former East Prussia, most of Pomerania, and a small part of eastern Brandenburg. The 2,000,000 Germans were expelled in 1946. The western territories are more industrialized than the lands lost to the U.S.S.R.

The population now is almost entirely Polish in ethnic origin; prior to World War II about one-third of Poland's population (35,000,000 in 1939) belonged to minorities—750,000 Germans,

ca. 3,300,000 Jews, and ca. 5,000,000 Ukrainians. There are now about 50,000 Germans and only about 35,000 Jews. Most of the Jews were exterminated by the Germans during World War II, and many of the survivors have emigrated. The largest cities are Warsaw and Lodz. In 1957 about 54 per cent of the population was rural, compared with about 69 per cent in 1946.

RELIGION: More than 96 per cent of the population are Roman Catholics, and the Catholic faith and the Church have played a most important role throughout Polish history. Under Communist rule, the Church has been oppressed. The conflict between the State and the Church broke out as soon as the postwar government was established in 1945. The government in 1946 repudiated the concordat, suppressed all Catholic charity organizations, and restricted the rights of the Church in education and youth work. The conflict was apparently resolved in April 1950, but the agreement was soon violated by the government, which made ecclesiastical appointments subject to government approval and arrested many priests, including, finally (Sept. 26, 1953), the primate of Poland, Stefan Cardinal Wyszyński. The campaign was apparently ineffective, and upon the ascendancy of Communist party secretary Władysław Gomułka, in October 1956, the government released the cardinal, reintroduced religious education into the schools, and freed the Church of other limitations.

EDUCATION AND CULTURE: Poland has had free, compulsory elementary education since 1921, and much progress has been made in eliminating illiteracy. Secondary education is free and compulsory. Until October 1956, however, the emphasis upon Russification and Marxist materialism, the purging of most non-Communist teachers, and the emphasis upon technical training seriously reduced the quality of education. There are ca. 7,500 nursery schools, with some 368,000 children enrolled; 24,500 elementary schools, with an enrollment of 3,900,000; and 824 high schools, with 195,000 students. Some 75 institutions of higher learning provide advanced training for 170,000 students. Illiterates below the age of 50 are obliged to attend specially organized schools and courses.

Polish literature is particularly rich in historical, political, and poetical writing. The period of humanism in the 16th century was its first period of development, with such contributors as Mikołaj Rej (Nicholas Rey), Piotr Skarga, and Jan Kochanowski. During this period, scientific development flourished at Cracow Univ. (founded in 1364). Polish literature declined in the 17th century but experienced a revival in the late 18th and early part of the 19th centuries, when it promoted the ideas of the Enlighten-

ment (*q.v.*). These were reflected in the constitution of May 3, 1790, which established principles similar to those of the French and American constitutions. At this time, too, a ministry of education, the first in Europe, was founded. Polish culture, and literature in particular, reached a pinnacle, during the romantic period, in which the standards in music were set by Chopin and in literature by Adam Mickiewicz, Juliusz Słowacki, and Zygmunt Krasiński. Romantic literature became a weapon for freedom in the country, which was then divided among three neighboring powers. Masters of the modern Polish novel are Józef I. Kraszewski, Bolesław Prus (pseudonym of A. Glowacki), and Henryk Sienkiewicz and Władysław S. Reymont, two Nobel Prize winners. The period between the two World Wars was marked by a rebirth of poetry, exemplified by Julian Tuwim and Antoni Słonimski; novelists were Zofia Nałkowska, Marja Dąbrowska, and Józef Wittlin. This period also contributed a number of important war memoirs and volumes reflecting contemporary problems; the most significant of such writers is Severyna Szmaglewska. Literature and the arts under the Communists have been used as political weapons, and the quality, generally, has not been high. Dissatisfaction expressed by intellectuals laid the foundation for the October Revolution in 1956.

LANGUAGE: The Polish language belongs to the northwestern Slavic branch of the Indo-European family of languages. It shows closest affinity with Czech, Slovak, and Lusatian Wendish. Next to the Russian and Ukrainian, it is the most widely used Slavic language, with about 30,000,000 persons using Polish as their mother tongue. Like all other Slavic languages, it is highly inflected, possessing seven cases and declining both its adjectives and nouns. It uses the Roman alphabet with the addition of certain signs and fixed combinations of letters to express some 36 sounds.

AGRICULTURE AND ECONOMY: Traditionally, Poland has been an agricultural country, but since the 1920's, particularly after World War II, the gap between agriculture and industry has been considerably narrowed. Thus, in 1957, 54 per cent of the population was rural, compared with 69 per cent in February 1946 and 73 per cent in 1938. Cultivated areas represent almost half of the total land of the country. The main agricultural products are rye, potatoes, oats, wheat, barley, and sugar beets. Dairy farming, stock raising, and lumbering are important occupations.

Poland's mining output includes considerable quantities of coal, natural gas, salt, potassium salts, iron ore, and zinc. Outstanding industries are coal mining and iron and steel working in



Courtesy Eastfoto

MECHANIZATION IN POLISH COAL MINES

the Silesia and Kielce areas; the textile mills of Lodz and Bialystok; and the metallurgical industry of Warsaw, Lodz, and Poznań. All these were well developed in the 1930's. Polish industry was augmented by the incorporation of German Silesia, particularly Wroclaw, in 1945.

Immediately after World War II, all estates of more than 125 acres were broken up and divided among landless peasants and former laborers. Heavy industries, such as coal, iron, textiles, cement, and construction, as well as banks, were nationalized, and the Communist government has taken over the management of all but the smallest industrial enterprises. Public utilities, such as power plants, railways, airlines, and shipping are owned and operated by the government.

Reconstruction of the war-devastated areas and integration of the territories acquired after the war with the rest of the country has been remarkable, and Poland has made considerable industrial progress. By 1953, the share of industry in the national income had reached 52 per cent. Industry was expanded under a series of plans—a Three-Year Plan (begun 1947), a Six-Year Plan (begun 1950), and a Five-Year Plan (begun 1956)—under which output was to be increased by 53 per cent. In 1958 Poland produced 95,000,000 tons of coal (36,200,000 in 1937), 5,630,000 tons of steel (1,500,000 in 1937), and 23,946,000,000 kw. hr. of electricity (3,600,000,000 in 1937). Textile output doubled in the same period. These goals were achieved, however, at the cost of a painfully low standard of living and of Soviet exploitation (*e.g.*, between 1945 and 1956, the U.S.S.R. paid Poland *ca.* \$3 a ton for coal which sold elsewhere in Europe for at least \$18). Industrialization was also accompanied, especially after 1948, by the forced collectivization of agriculture; and by 1954 there were 8,000 collective farms. Collectivization, however, proved an expensive failure, and Poland was forced to import large quantities of grain. In addition, individual farms were yielding 16.7 per cent more produce to the acre than collective farms and 37.2 per cent more to the

POLAND

acre than state farms. When the peasants were given a choice in October 1956, most of them left the collective farms, 85 per cent of which were soon dissolved; in 1958 Poland had only 1,800 collective farms.

GOVERNMENT: Poland is a Communist-controlled state, in the form of a republic. The Polish parliament (Sejm) unanimously approved a new constitution on July 22, 1952, which in most respects follows the pattern of the Soviet constitution of 1936. Accordingly, a 15-member council of state is the highest organ of government. The Sejm is in theory "the highest organ of state authority" but holds no actual power. The first parliament, elected Oct. 26, 1952, for a four-year term, was on a one-party ticket, all 425 candidates representing the National Front, which is dominated by the Polish United Workers' (Communist) party. Elections to the second Sejm, in January 1957, had more freedom. A premier heads a council of ministers, which is elected by, and is in theory accountable to, the Sejm. Home rule is by elected people's councils.

HISTORY: Poland's earliest status as a nation dates from the union of several small Slavonic tribes and principalities in the basins of the Vistula, the Warta, and the Oder rivers under Mieczyslaw I (969-92). He was converted to Christianity in 966, and the first Polish bishopric was established at Poznań during his reign. His son, Boleslas I (992-1025), consolidated the nation, extending its frontiers and gaining the recognition of the Holy Roman emperors. Poland reached its greatest power in Europe in the 14th and the 16th centuries. During the reign of Casimir the Great (1333-70), Poland's prosperity and commerce increased considerably: the famous Statute of Wislica (1347) laid the foundation of the law of Poland; and Galicia was annexed.

Under the rule of the Jagellon dynasty (1386-1572), Lithuania was united with Poland. Under one of the Jagellons, Sigismund I (1506-48),



Courtesy Eastfoto

SIGISMUND I ACCEPTS HOMAGE



Courtesy Eastfoto

POLISH FOLK COSTUMES

Poland rose to dominate Eastern Europe. When that line of rulers became extinct, successive elective kings were put in power, resulting in a weakened central authority and increased power for the nobles and landed gentry. During the 17th century, Poland's position declined in the face of internal difficulties and attacks from neighboring powers. Ultimately, in the latter 18th century, the Polish commonwealth was partitioned three times (1772, 1793, and 1795) and divided among Prussia, Russia, and Austria. Reborn as a small state during the advance of Napoleon (1807), Poland again lost its identity as a nation by the division of its lands after Napoleon's defeat (Congress of Vienna, 1815). Only a small district around Cracow remained independent (to be annexed by Austria in 1848).

Throughout the 19th and the early 20th centuries, the desire for Polish independence grew strong. The powerful rebellions against Russia, in 1830-31 and 1863, and the revolts against Austria, in 1846 and in 1848, failed; but the resolution of the Poles in battle and the efforts of the Polish *émigrés*, especially in sympathetic France, strengthened the determination of the Polish nationalists. World War I brought Poland its independence again, for the first time since 1795, because of the defeat of the three powers which had partitioned Poland, the efforts of the Poles themselves, especially the Polish legions under Józef Piłsudski (*q.v.*), and the interest of the victorious Allies in the creation of an independent Poland, which President Wilson had promised in his Fourteen Points (*q.v.*). Consequently, the Republic of Poland was established in 1919. Conflicts with Germany, Czechoslovakia, and Lithuania over boundaries were resolved early in the 1920's, and the eastern boundary with the Soviet Union was defined by the Peace of Riga in 1921, ending two years of war with the Soviet Union, in which France provided much help to Poland. The first regularly elected par-

liament and president came to power in 1922, but, after four years of political conflict and confusion, Marshal Piłsudski seized power by a *coup d'état* and established a form of dictatorship under which he governed until his death in 1935.

Poland made immense progress under its various governments before 1939, even though it was plagued by poverty, inflation, the necessity of maintaining large military forces, the problems involved in recreating the unity of the state and the people, and political dissension. Poland's principal weakness was, however, its geographical location as a buffer between two powerful and dissatisfied nations, Germany and the U.S.S.R. In addition, its strained relations with two of its other neighbors, Lithuania and Czechoslovakia, prevented the creation of a strong bloc of East European states. Poland was allied with France after 1921, and it tried to calm an aggressive Hitlerian Germany with a nonaggression treaty in January 1934. Nevertheless, as soon as Hitler had rearmaged Germany, and as soon as his other conquests in Central Europe had been completed, he turned upon Poland, launching a military invasion on Sept. 1, 1939, after the conclusion of a nonaggression pact with the U.S.S.R. on Aug. 23. The German invasion was followed by a Soviet invasion from the east on Sept. 17. On Sept. 29 Poland was divided for the fourth time, this time between Germany and Russia. By a Russo-German treaty, the U.S.S.R. acquired 77,606 sq. m. of territory and about 13,000,000 people, including about 5,000,000 Poles. Germany occupied 72,864 sq. m. of territory and acquired about 22,000,000 people. In 1941, during the German invasion of the U.S.S.R., the Russians were driven from Poland, but the Poles continued to fight valiantly against the German occupation forces throughout the war in underground movements. During the Russian advance in 1944, Russian troops "liberated" all of Poland, but this liberation proved to be the prelude to another form of captivity.

A Polish government-in-exile, first set up in Paris on Sept. 30, 1939, was transferred to London on June 20, 1940, and a Polish army and air corps continued to fight on the side of the United Nations with distinction. The government was headed until his death in 1943 by Gen. Władysław Sikorski, who was both premier and commander in chief of the armed forces, with a representative national council as a kind of advisory body. This government was denounced by the U.S.S.R. in the spring of 1943, when it sought an investigation by the International Red Cross into the murder of about 4,000 Polish officers at Katyn, near Smolensk. It later became evident that these and about 10,000 other officers were murdered by the Russians as

part of their effort to destroy the future Polish leadership. This massacre and the deliberate refusal of the Russians to assist the Poles who rose in Warsaw against the Germans in August and September 1944 were among the Soviet actions which most inflamed the Poles.

In July 1944 the U.S.S.R. organized a Polish Committee of National Liberation in Moscow, which was moved to Lublin, Poland, when the city was retaken. This committee, on Dec. 31, 1944, proclaimed itself the provisional government of Poland and received Soviet recognition. After Big Three discussions at Yalta in February 1945, the U.S.S.R. agreed to "reorganize on a broader democratic basis . . . the provisional government which is now functioning" by the addition of Polish democratic representatives from abroad and from Poland. After long negotiations, the Polish Government of National Liberation was formed on June 23, 1945, comprising a cabinet of 23 members; five were non-Communists, all others came from the Communist Lublin organization. Most Poles were dissatisfied with this arrangement and the government's failure to hold immediate elections. For diplomatic and other reasons, however, the U.S. and Britain, in July 1945, withdrew their recognition from the London government and recognized the new one. The Communists then used their power to increase their control over Polish life and to end the country's independence. When their position was secure, they staged an election on Jan. 19, 1947, in which the so-called government bloc, the Communists and their servile Socialists, won 394 of the 444 seats and subsequently formed a government which they completely dominated. The U.S. and Britain denounced the elections, in which terror and fraud had played a large role, and relations between Poland and the West became strained. On Feb. 19, 1947, a so-called Little Constitution, which settled the structure and spheres of activity of the supreme organs of the state, was adopted. With two decrees, providing for the nationalization of industry and the elimination of opposition, it constituted the basis for the organization of a state on the Soviet model.

In December 1948 the Socialist party and the Workers' party merged into the United Polish Workers' (Communist) party, which came to dominate all political activities. The merger was followed by a Kremlin-type purge of the party, the best-known victim of which was Wladyslaw Gomulka, vice premier and secretary general of the party. The appointment (Nov. 7, 1949) of Soviet Marshal Konstantin Rokossovsky (*q.v.*) as minister of defense and commander in chief of the Polish armed forces—in which most higher positions were occupied by Russian officers—and the election of Rokossovsky to the

party's central committee brought Poland openly under Soviet control.

For nearly seven years, Poland continued as a vassal of the U.S.S.R., but in June 1956 bloody riots broke out in Poznań, which reflected the Poles' dissatisfaction with poor conditions and living standards. The rebellion—probably sparked by a remarkable relaxation of Communist rule during the previous year or 18 months—also showed the people's anti-Russian tradition and the hatred felt for numerous Soviet actions. Criticism began to come to the fore from intellectuals in particular, and the press became very frank in criticizing the government, the economic situation, and the U.S.S.R. The subsequent Poznań trials were unique in recent Communist history—they were public, the accused were allowed to defend themselves, confessions extorted by the police were withdrawn in the court, the police were criticized, many grievances were aired by the defendants and their lawyers, and the punishments meted out were, indeed, very mild for a police state.

On Oct. 19, at the eighth meeting of the central committee of the party, the Stalinist members were ousted; and Gomulka, imprisoned for almost four years, was restored to power and made first secretary of the party. Marshal Rokossovsky subsequently lost his posts and returned to the U.S.S.R. These actions were carried out in the face of strong Soviet threats of retribution and troop movements, but Nikita S. Khrushchev (*q.v.*) and an entourage of high Kremlin functionaries, who had flown to Warsaw, were unable to reverse the process which established Poland as a national Communist country.

The ascendancy of Gomulka to power was followed by the removal of Soviet officers and advisers, the release of Cardinal Wysinski from prison, and the conclusion of a new agreement between the Church and State. Negotiations in Moscow led to an agreement (Nov. 18) which declared that future relations would be based on "complete equality, respect for territorial integrity, national independence, and sovereignty and noninterference in each others' internal affairs" and provided for Russian economic concessions. It also provided for the repatriation of Polish citizens from the U.S.S.R. and entitled Soviet troops to remain in Poland until a German peace settlement had been reached, but it gave Poland control over the location and movement of those troops. This, and a later agreement about the stationing of Soviet troops, concluded a revolution which had profound effects upon world politics, especially upon international Communism.

The January 1957 elections, conducted with far greater freedom than those of 1947 and of

POLAR EXPLORATION

1952, provided Gomulka with 98.4 per cent of the vote, enabling him to repair the country's economy. Gomulka's prestige throughout Poland spread quickly, in spite of his 1942-48 record and in spite of his being a fervent Communist, because he was imprisoned from 1951 to 1955, because he effectively advanced Polish independence against the Russians, and because he tolerated private farming and advocated increased investment in the consumer-goods industries and greater freedom and power for the Catholic Church. The U.S. strengthened the Gomulka regime's independent course by extending aid—amounting to almost \$200,000,000 by 1959.

Gomulka, however, faced many problems. He had to maintain control of those groups both within and outside of Poland's Communist party who wanted to make changes in the country's program and political structure beyond the changes made after the 1956 revolt. Thus, he had to steer a middle-of-the-road course between the Stalinists on the Right and the "revisionist" wing on the Left. At the same time, he had to improve the economy without abandoning the programs and controls considered vital by the Communists. Finally, he had to try to maintain Poland's limited independence from Russia in the face of mounting pressure, as Khrushchev solidified his power in Russia and the Soviet Communist party launched an international campaign against "reformism," as exemplified by Tito and the "National Communism" of Yugoslavia. Gomulka managed to achieve these goals, but in 1958 and 1959 he did so only by permitting increased restrictions in Poland and by following closely the Soviet views on "Titoism" and all international issues.

Polar Exploration (*pō'ler ěks-plō-rā'shūn*).

The Arctic regions and sea have been the object of more extensive exploration than the Antarctic, probably because they are closer to the important maritime nations and their waters are more accessible than those to the south. An added stimulus to exploration in the Arctic was the centuries-long search for northwest and northeast passages from Europe to China.

ARCTIC. The first historically known Arctic explorer was the Greek Pytheas. Sailing from Massalia (Marseilles) about 325 B.C., he journeyed to Great Britain. Thence he sailed north for six days to Iceland, which to him was Thule, and one day beyond Iceland to the vicinity of present Scoresby Sound, where he was the first European to report the dense fog that overhangs the meeting edges of northeast-flowing Gulf Stream waters and the southwesterly Greenland current. Irish records of about A.D. 825 established that Iceland was then well known to the Irish, whose first voyages thither, and to Greenland, may have been those chronicled in the



Courtesy Bettmann Archive, N. Y.

BARENTS' WINTER CAMP, 1594

Brendan cycle, thus about the 6th century. Icelandic sagas confirm the fact that Irish monks were living in Iceland before the advent there (in the 9th century) of the Norsemen. The Norse not only traveled westward in their explorations, but northeast as well. Ottar (Othere) sailed around the North Cape above the Scandinavian Peninsula about 870 and continued eastward to the south coast of Kola Peninsula, where he entered the White Sea.

From Iceland it was but a step to Greenland. Gunnbjorn Ulfsson, voyaging to Iceland, was driven off his course and may have been the first colonist of Iceland to sight the Greenland shore, late in the 9th century. Eric the Red, however, is considered the actual discoverer of Greenland, in the sense that it was he who conducted the most extensive exploration in that region, about 985, later founding a colony from Iceland there. The settlements grew and the island became a base of extensive seal- and whale-hunting operations. From Iceland a country named Svalbard was discovered in 1194. It is disputed whether this was Spitsbergen, Jan Mayen or the Scoresby region of Greenland, probably the last.

In the year 1000, Leif, the son of Eric the Red, was on his way home to Greenland from Norway. Missing Greenland, he continued on the same course until he reached the continent of America, almost certainly Labrador, possibly Newfoundland or Nova Scotia. By 1300 the Norwegians, Icelanders, and Greenlanders had explored from Novaya Zemlya in the east to Labrador in the west. Then, or a little later, they penetrated 1,000 m. beyond the Arctic Circle along the west coast of Greenland, as we have learned in recent years from archeological studies.

The British, following Columbus' rediscovery of America in 1492, sent John Cabot west in 1497. Cabot touched at Cape Breton and Nova Scotia and possibly Labrador. Greenland may have been visited by the Portuguese Gaspar Corte-

Real around 1500 and Newfoundland was certainly visited by him. It is disputed whether the voyages of Cabot and Corte-Real preceded an influx of fishing vessels in the southern Arctic waters of the Western Hemisphere; certainly they were responsible for drawing attention to this region, both for fishing and whaling. The records of the fishing and whaling vessels were well guarded; little is known of their voyages.

Sebastian Cabot is said to have attempted to find a northwest passage to China in 1508-09 and Henry VIII in 1521 tried to interest merchants in fitting out an expedition for a similar purpose, but what became of the idea is not known.

In 1553 an expedition, of which Sebastian Cabot was the promoter, set sail under Sir Hugh Willoughby and Richard Chancellor to attempt the northeast passage. The small fleet of ships became separated in a gale. Willoughby and his men perished, but Chancellor rounded the North Cape, proceeding by ship to the mouth of the Dvina River, later the site of Archangel. The importance of this voyage lies principally in its commercial aspects, for Chancellor proceeded on foot to Moscow, where he secured trade agreements with the czar. As a result of Chancellor's expedition, the Muscovy Co. of Merchant Adventurers, for long thereafter active in Arctic exploration, was formed. This company sent Stephen Burrough, who had sailed with Chancellor, to locate the Ob River, of which rumors had been heard. Burrough reached, not the Ob, but Novaya Zemlya, Vaigach Island, and the Kara Strait. In 1580 the Muscovy Co. sent an expedition northeastward to discover a route to China, but the voyage was a failure.

Some believe the Portuguese attempted to pierce the northwest passage in 1574 and that they penetrated Hudson Bay.

Sir Martin Frobisher, of England, backed by Queen Elizabeth and the Muscovy Co., followed in Corte-Real's wake in 1579, journeying as far as southern Baffin Island. The next attempt to find a northwest passage was made by an expedition under John Davis. Leaving England in 1585, Davis sailed westward, touching at Greenland, crossing the strait now called Davis Strait, exploring the east coast of Baffin Island, and discovering Cumberland Sound. Though he believed this to be a strait which would provide a route to the Indies, Davis was forced by unfavorable winds to return to England. In subsequent voyages he made further explorations along the coast of Baffin Island and journeyed as far south as Labrador. His explorations in these regions were extensive and added much to contemporary knowledge.

In The Netherlands, meanwhile, where merchants were barred from the southern route by the Spanish and Portuguese, there was an

awakening to the importance of a route to the East by northern European waters. Olivier Brunel took the lead in this movement, having traveled along the north European coast to the Ob River and as far afield as Novaya Zemlya. Dutch merchants had penetrated to Kola by 1565 and a few years later a small Dutch settlement was established on the site of the future Archangel. In 1594, a Dutch expedition set sail, two of its ships under Willem Barents. Novaya Zemlya was sighted by this party and its coast explored. Cornelis Nay, commanding two other ships of the same expedition, sailed into the Kara Sea through Yugor Strait, which they discovered, voyaging as far as Yamal Peninsula. Thinking they had discovered the northeast passage, they returned home. A return expedition tried repeatedly, but without success, to enter Yugor Strait.

Sailing from Holland in 1596, another party discovered Bear Island and, further north and far more important, Spitsbergen. Returning to Bear Island, the expedition split up. Barents and Heemskerck voyaged eastward, rounding the northern tip of Novaya Zemlya and spending the winter on the island's northeast coast, the first successful attempt by Dutch or British to winter in the Arctic.

A great explorer of the 17th century was Henry Hudson. The Muscovy Co. employed Hudson and in 1607 he set out on his first voyage. On this and subsequent journeys, he studied the ice conditions between Greenland and Novaya Zemlya, traveling along Greenland's east coast to 73° N., and explored the west coast of Svalbard; in this region he reached about 80° N. The Dutch East India Co. engaged his services next and, in their name, he approached the American coast, sailing up the Hudson River in what is now New York State. In 1610, he entered Hudson Strait, passing through into the great bay north of Canada which bears his name. On the return voyage, Hudson, his son, and some sick men were set adrift in Hudson Bay by a mutinous crew and perished. Spitsbergen, whose waters received favorable comment from Hudson, soon became the center of an extensive whaling, walrusing, and sealing industry.

Knowledge of Hudson Bay advanced apace. Its western shore was explored by an expedition under Sir Thomas Button in 1612. Button discovered Nelson River (57° 10' N.). Subsequent voyages under Button and under Robert Bylot and William Baffin explored the regions surrounding Hudson Bay. In 1616, Baffin and Bylot sailed around Baffin Bay, reaching as far north as Smith Sound. One of Baffin's achievements on this voyage was discovery of a channel extending northward from Davis Strait, but since his journals and maps were ignored for some time, this discovery remained obscure. Three years after

Baffin's trip, two Danish ships commanded by Jens Munk set out to find the northwest passage, but, wintering on Hudson Bay near the Churchill River, all perished except Munk, a man and a boy, who succeeded in reaching home in the smaller of the ships. Two English expeditions were sent forth in 1631, under Luke Foxe and Capt. James, who explored Hudson Bay.

Interest in Hudson Bay resulted in the establishment in 1670 of a Hudson's Bay Co., whose fur-trading charter contained a provision that they were to search for the northwest passage. They did little about this, but, after 100 years, began to send out men who tagged along with bands of wandering Indians. The Coppermine River was reached and followed almost to the sea by Samuel Hearne (1769-72). A North Western Co. man, Alexander Mackenzie, became the discoverer of the mouth of the river which bears his name.

Though their primary interest was in whaling, fishing vessels contributed considerably to knowledge of Arctic regions. The northern tip of Novaya Zemlya was rounded by a Dutch captain, Vlamingh, in 1664. A German surgeon, Frederick Martens, produced the (up to then) most authoritative account of Spitsbergen and its environs after a visit there in 1671.

The British government, seeking to encourage exploration, offered (1776) £5,000 to the first ship to reach the 89th parallel. William Scoresby, a whaler and scientist, is prominent in this period. His work, "Account of the Arctic Regions," surpassed that of Martens as an authority. Scoresby reached $81^{\circ} 12' 42''$ N. in 1806, and in 1822 he explored the perilous eastern coast of Greenland from 69° to 75° N.

The Russians, in the meantime, had been conducting explorations on the opposite shores of the Arctic. Simon Dezhneff voyaged (1648) from the Kolyma River in northern Siberia around Asia's easternmost tip, through Bering Strait to the Gulf of Anadir. Lt. T. Chelyuskin explored the waters at 104° E., reaching $77^{\circ} 25'$ N. at the cape now called Cape Chelyuskin. Eight years later he made a sledge journey in the same region, rounding the cape. Peter the Great had commissioned a Dane, Vitus Bering, to conduct explorations along Siberia's northeastern coast. Bering, putting out from Okhotsk, reached what is now Bering Sea and made extensive explorations in the Aleutian Islands. In 1771, Lyakhov, a Russian trader, explored the northern Siberian waters, discovering the islands named for him and the New Siberian Islands.

English expeditions in the 18th century include those of J.C. Phipps, who explored (1773) Spitsbergen, discovering the Seven Islands and Walden Island, and reaching $80^{\circ} 48'$ N., and James Cook, who put out from Kamchatka

(1778) to discover either a northeast or northwest passage. After passing through Bering Strait he was stopped by ice at $70^{\circ} 41'$ N.

The French revolution and Napoleonic wars temporarily halted polar research, but in 1815, Sir John Barrow emerged in England, an energetic champion of Arctic exploration. In 1818, at his instigation, the British offered a reward of £20,000 for any one discovering the northwest passage and £5,000 for reaching the 89th parallel. In the same year, two expeditions set sail under Barrow's aegis, one under D. Buchan and G.W. Beechey searching for a route from Spitsbergen and the other under Sir John Ross, who followed Baffin's route of 1616. Though the latter reached Lancaster Sound north of Baffin Island, Ross believed it to be only a bay and returned home. One of his officers, Parry, however, held the opposite view and a year later led a second expedition through Lancaster Sound to Barrow Strait, advancing as far westward as Melville Island, where they wintered. The pack ice prevented Parry from continuing westward to what would have been discovery of the northwest passage. He made repeated attempts to proceed past Melville Island, but all failed.

John Franklin, who had been one of Buchan's officers, had meantime been employed in the overland exploration of the northern parts of North America, expanding the discoveries of Hearne and Mackenzie. His journey took him to the Great Slave Lake, down the Coppermine River, and along Canada's northern coast from the mouth of the Coppermine 550 m. E. to Cape Turnagain in $109^{\circ} 25'$ W. long. Parry and Franklin, with Capt. Beechey, planned (1824) a combined expedition of three parties, Parry's to proceed through Lancaster Sound, Beechey's through Bering Strait eastward, and Franklin's by land in Canada. Franklin's party traveled the Mackenzie River to the point of its entrance into Beaufort Sea, and, turning west, explored the coast line for about 375 m. A branch party led by Dr. John Richardson proceeded eastward, covering the shore between the Mackenzie and the Coppermine. Beechey advanced through Bering Strait and reached as far as Point Barrow in $71^{\circ} 23' 30''$ N. Parry was again stopped by polar ice.

Parry now turned to another sector of the Arctic, making an attempt on the North Pole in 1827, setting forth from Spitsbergen by sledge-boats. The party reached $82^{\circ} 45'$ N., but turned back when they discovered that the masses of ice on which they were traveling were drifting southward at a rate faster than the party could move north.

The North Magnetic Pole, on Boothia Peninsula, was discovered in 1831 by (later Sir) James Clark Ross, an officer of an expedition

commanded by his uncle, voyaging through Prince Regent Inlet into the Gulf of Boothia. The Rosses spent four winters in the region of Boothia Peninsula, unable to free their boat from ice. Rescued by a whaler, they returned to England in 1833, with a valuable store of knowledge concerning the northern shores of America.

The Hudson's Bay Co. completed the charting of Canada's northern shores by expeditions sent out in the first half of the 19th century under command of Peter W. Dease and Thomas Simpson. It was not realized until long afterwards, that Simpson had really discovered the northwest passage as well.

In 1846 Dr. J. Rae, of the company, completed the work, linking Parry's findings with those of the Rosses and establishing Boothia Peninsula as a part of the continent.

The Russians were conducting explorations in Siberia with the same end in view. The New Siberian Islands were surveyed (1821). Baron Wrangel conducted (1820-23) research along Siberia's northern shore and in 1843, A.T. Middendorf completed the delineation of Siberia's northern coastline with explorations near Cape Chelyuskin.

Sir John Franklin now made (1845) another and (for him) final attempt to penetrate the northwest passage via Lancaster Sound to Bering Strait. Passing down the east coast of Prince of Wales Island, he hoped to reach the coast of Canada, along which he would have traveled to Bering Strait. After passing the southern tip of Prince of Wales Island, the expedition foundered. The first search party was sent out in 1848, when John Ross proceeded to Lancaster Sound by ship and thence by sledge with Leopold M'Clintock along North Somerset Island's northern and western coasts. No trace of Franklin or his party was found and rescue expeditions were now sent forth in great number. R. Collinson and R. McClure sailed through Bering Strait, while Horatio Austin searched the Barrow Strait region with William Penny, a whaling captain. The winter quarters of Franklin's expedition were discovered by Austin and Penny at Beechey Island, but no indication could be found of the direction in which the ships sailed. The expedition conducted an exhaustive search throughout the area but nothing further was uncovered and they returned to England in 1851. Collinson and McClure became separated before reaching Bering Strait. Collinson's ship reached as far east as longitude $100^{\circ} 45'$ w. and the party advanced north by sledge to Melville Island. At his farthest east, Collinson was only a few miles from Point Victory where the mystery of Franklin's fate could have been solved. He returned westward, however, reaching England in 1854. McClure met with heavy ice conditions but managed to reach

the northern shore of Banks Island where his ship became ice bound. He journeyed across the ice to Melville Island where he left a record of the position of his ship found by another Franklin rescue party, which picked up McClure and his men in June 1853. They returned to England by an eastern route, McClure thus having traversed in reverse (though not entirely by ship), the northwest passage. The island groups north of Canada were extensively charted and explored on these rescue expeditions, both by ship and by sledge, and 7,000 m. of coastline were discovered. The first knowledge of Franklin, aside from the winter quarters, was found among the Eskimos by Dr. J. Rae in 1854, when he saw relics of the ill-fated expedition. U.S. parties had also taken part in the search for Franklin. Dr. E.K. Kane, who had become interested in polar research after accompanying a rescue party, conducted explorations through Smith Sound, coming within 17 m. of its northern entrance. On this voyage, Kane discovered a glacier with a sea face 45 m. long to which he gave the name Humboldt Glacier. Another American, Charles Hall, discovered (1864-69) on King William Island (south of Boothia Peninsula and east of Victoria Island) remains of the survivors' party of Franklin's expedition. Another expedition took Hall up Smith Sound to $81^{\circ} 38' \text{ N.}$

The Norwegian and Swedish explorers had, in the meantime, been concentrating their efforts on the waters north of Europe. German expeditions were also sent out, some exploring Greenland as well. Julius Payer and K. Weyprecht, heading an Austro-Hungarian party, set out in 1872 to find a northeast passage. Drifting with polar ice, the vessel sighted land in latitude $79^{\circ} 54' \text{ N.}$ The expedition wintered there, made extensive sledge journeys on the islands of the group, and named it Franz Josef Land (now Fridtjof Nansen Land). Abandoning ship, they were picked up by a Russian schooner and returned to civilization.

The British dispatched an expedition under Capt. G.S. Nares and Capt. H.F. Stephenson to Smith Sound in 1875. One vessel wintered in Lady Franklin Bay at $81^{\circ} 44' \text{ N.}$ while the other pushed on to winter in the open sea facing the pack at $82^{\circ} 20' \text{ N.}$ A sledging party from this expedition reached a "farthest north" of $83^{\circ} 20' \text{ N.}$ and important geographical data were gathered. A Dutchman, Koolemans Beynen, interested his government in polar research and several Dutch expeditions set sail, largely for purposes of collecting geographical and other scientific knowledge. A steam yacht expedition led by B. Leigh-Smith, an Englishman experienced in polar research, discovered Alexandra Land southwest of Franz Josef Land, in 1880.

Expeditions in northern European waters stim-

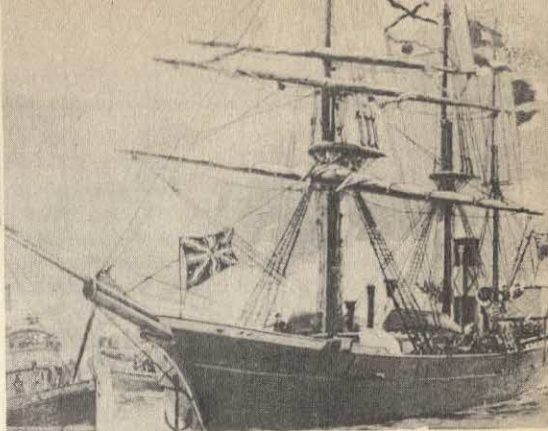
POLAR EXPLORATION

ulated interest in a northeast passage and after several preliminary voyages, A.E. Nordenskiöld set sail from Gothenburg in 1878. They sailed on July 4 and by Aug. 19 reached Cape Chelyuskin. Frozen in during the winter, the vessel passed through Bering Strait in July 1879, having successfully navigated the northeast passage.

In the U.S., Gordon Bennett fitted out an expedition which set sail from San Francisco in 1879, heading for Bering Strait. The vessel passed through the strait and proceeded westward along Siberia's northern coast. Finally caught by pack ice and held captive for 22 months, the ship sank in latitude $77^{\circ} 15' \text{ N.}$ and longitude 155° E. In an attempt to reach the mouth of the Lena River, the three surviving boats were separated, only one managing to return to safety.

A.E. Nordenskiöld conducted another expedition, this time into Greenland (1883), in a journey over the island's inland ice. The group went about 84 m. inland from the west coast, reaching an altitude of 5,000 ft. The nations of the world now pooled their resources to study Arctic conditions. In 1875 Weyprecht proposed the establishment of stations at fixed points near the Arctic and Antarctic Circles to study meteorological and magnetic conditions. Each nation accepting the proposal agreed to establish one or more stations to make simultaneous observations for a full year beginning in August 1882. The nations subscribing were Norway, Sweden, Holland, Russia, Finland, the U.S., Great Britain, Germany, Denmark and Austria-Hungary. Save for the Dutch, who became icebound and were forced to make their observations aboard ship, the experiment was a success. There were two U.S. expeditions. The western, commanded by Lt. P.H. Ray, U.S. Army, was uneventfully successful at Point Barrow, Alaska. The eastern, commanded by Lt. A.W. Greely, U.S. Army, established their base at Lady Franklin Bay in August of 1881. The two winters which followed were without incident save that Lt. Lockwood made a "farthest north" of $83^{\circ} 24'$, and several other exploration trips were made. The relief ships did not appear in 1882 nor again a year later, so Greely moved the party southward by boat to Smith Sound, expecting to find the relief ships there. Abandoning the boats, they moved southward across the ice, reaching Cape Sabine where they wintered. By spring of 1884 supplies were entirely gone and the men slowly died of starvation. When the relief ships finally appeared in June 1884, there were only seven men still barely alive. The scientific records, however, were intact and complete. The early relief ships had turned back because of difficulties which seemed comparatively small indeed.

Interest was again revived in penetrating Greenland's inland ice. Lt. Robert E. Peary of the U.S. Navy in July 1886 traveled eastward



Courtesy Bettmann Archive, N. Y.

RETURN OF THE PEARY EXPEDITION IN 1909

Arrival of the *Kite* in Philadelphia after Robert E. Peary's eighth attempt to reach the North Pole proved successful

from Disco Bay penetrating 100 m. inland to a height of 7,500 ft. Establishing a new principle in Arctic exploration, Fridtjof Nansen and Otto Sverdrup, with five others, landed on Greenland's east coast in August 1888, in $64^{\circ} 23' \text{ N.}$ In thus starting at the point most difficult of access and proceeding to easier terrain, Nansen eliminated any chance of turning back. Within two weeks the party had attained the west coast. Other crossings of Greenland were made by Alfred DeQuervain, in 1912; Knud Rasmussen with Peter Freuchen, 1912; J.P. Koch with Alfred Wegener, 1912; and Laue Koch in 1921. Nansen carefully studied Arctic winds and drift and arrived at the conclusion that there might be a drift across the Pole. Accordingly, he organized an expedition, designing a special ship, the *Fram*, built to resist the pressure of ice. Leaving Christiania in summer 1893, Nansen took the *Fram* eastward and in September she became icebound in $77^{\circ} 30' \text{ N.}$, off the New Siberian Islands. Her design was such that the ice lifted her bodily and carried her thus for the duration of the drift. The highest latitude reached by the ship was $85^{\circ} 55' \text{ N.}$ in longitude $66^{\circ} 31' \text{ E.}$, November 1895. Nansen and a companion left the ship (at 84° N. , 102° E. in March

WILKINS' PLANE AT POINT BARROW, ALASKA, 1928

Courtesy American Geographic Society, N. Y.



1895) to travel toward the Pole by ski, dog sledge, and kayak. They reached a "farthest north" of $86^{\circ} 5' N.$ on Apr. 8. Turning southwest, they reached Norway in August 1896.

American, Russian, and Italian expeditions now made assaults on the Pole from various points without success. The Italian group, under Prince Luigi, Duke of Abruzzi, went north from Franz Josef Land reaching $86^{\circ} 34' N.$ in latitude $65^{\circ} 20' E.$ on Apr. 25, 1900. A daring attempt was made in 1897 when S.A. Andree, Swedish aeronaut, and two companions, set forth by balloon from Spitsbergen. All traces of the aeronaut and balloon were lost and not recovered until 1930 when Dr. S. Horn, leading a Norwegian scientific expedition, found the remains on White Island. Andree's diary stated that they had reached a little more than $83^{\circ} N.$ when they were forced down and the balloon abandoned. They had marched southward, but perished on White Island. Other expeditions which contributed much knowledge of polar regions, although they never actually reached the Pole, were the Baldwin-Ziegler expedition of 1901-02 and the Fiala-Ziegler expedition of 1902-05.

In 1903 Roald Amundsen (later the first to reach the South Pole) set out from Christiania to traverse the northwest passage, using the Lancaster Sound entrance. En route, sledging parties were sent out to make geographical and scientific observations. In 1906 the ship passed through Bering Strait into the Pacific Ocean, the first to follow from ocean to ocean the long-sought northwest passage. Amundsen later traversed the northeast passage as well.

In the meantime, Robert Peary was laying the groundwork for his trip to the North Pole, making exhaustive studies of possible routes and conditions. After two unsuccessful attempts, he reached his goal and the goal of centuries, setting up the American flag at the North Pole, Apr. 6, 1909. He returned safely and easily. Peary's claim was disputed by Dr. Frederick A. Cook who had spent two winters in the Arctic (1907-09) and declared that he and two Eskimos had reached the Pole a year before Peary. Cook's claims, however, were never substantiated. Bradley Land, $85^{\circ} N. 102^{\circ} W.$, was photographed by Dr. Cook. This area has to date not been further explored.

An expedition under MacMillan (1913-17) explored hitherto unknown lands north of Grant Land. On this voyage, Crocker Land, reported by Peary, was proved to be non-existent. Expeditions under Vilhjalmur Stefansson belong to this period, adding much to our knowledge of the regions farthest north from North America. Stefansson discovered (1915-17) the last lands that (apparently) can be discovered in the Arctic, the islands Borden, Brock, Lougheed, and Meighen. K. Rasmussen conducted research (1921-

24) into Eskimo culture, studying tribes throughout northern North America and Greenland. He also amassed geographical data in the same areas.

With the development of the airplane, aerial flights became an integral part of exploration. Richard E. Byrd of the U.S. Navy flew over the Pole (May 9, 1926) and back to his base at Spitzbergen within $15\frac{1}{2}$ hours, the first to fly over the Pole. Amundsen, Ellsworth, and Nobile flew for 71 hours over the Arctic Ocean in a dirigible, May 1926, crossing the Pole. In 1927 Sir Hubert Wilkins flew northeast from Point Barrow to $77^{\circ} 45' N. 175^{\circ} W.$ Here he landed and made echo soundings, 5,440 meters or 17,848 ft., the deepest in the Arctic. Wilkins made the first airplane crossing of the Arctic in this decade, flying from Point Barrow, Alaska, to Spitsbergen (1928). Gen Nobile made three polar flights in May 1928, basing his dirigible in Spitsbergen. Returning from the third flight, his airship was wrecked and the party came down east of Spitsbergen. Rescue parties were rushed to their aid and Nobile and most of the crew were saved. Roald Amundsen, however, a member of one of the rescue parties, was lost. Under the sponsorship of the International Aeroarctic Society the German airship *Graf Zeppelin* in July 1931, made a historic flight. Starting from Friedrichshafen, the ship flew via Berlin and Leningrad north to Franz Josef Land then to Severnaya Zemlya and returned via Archangel to Berlin. The scientists aboard gathered much valuable data. The Soviet Union in 1929 established a radio-meteorological station at Hooker Island, Franz Josef Land, the most northerly in the world. The Soviet Union also charted the entire length of the Arctic coastline in 1936, when the aviator V.S. Molokof circled the northern portion of the globe, covering 15,626 m. The possibility of using the Arctic as an air route between the U.S. and Russia led to survey flights. Ivan D. Papanin (who had conducted previous expeditions to the north polar regions) and three companions flew from Franz Josef Land to latitude $89^{\circ} 24' 9'' N.$ in May 1937, establishing a base on an ice floe there. During the subsequent drift of the floe for 274 days, important scientific data in every possible field were amassed. The party drifted down Greenland's east coast, reaching latitude $70^{\circ} 47' 5'' N.$ and longitude $20^{\circ} W.$ by Feb. 19, 1938.

Important scientific results were also achieved by the *Sedov* party. This Soviet icebreaker was frozen in the Laptev Sea in October 1937, and drifted across the Arctic Sea, more or less parallel and somewhat north of the famous *Fram* drift of 1893-96. The *Sedov* was freed by other icebreakers in the Greenland Sea in January 1940.

The Royal Canadian Mounted Police vessel *St. Roch* was the second ship to succeed in making the northwest passage. She left Vancouver, B.C.,

on June 21, 1940, wintered at Victoria Island, 1940-41, and at Pasley Bay, Boothia Peninsula, 1941-42. The *St. Roch*, under command of Sgt. H.A. Larsen, finally arrived at Sidney, Cape Breton Island, on Oct. 8, 1942. Following a more northerly course through Barrow Strait in 1944, the *St. Roch* was the first ship to make the journey in one season. She left Newfoundland on July 28 and reached Vancouver on Oct. 16, a distance of 7,295 m.

Many hydrographical and other data were gathered in the Greenland Sea by the Louise A. Boyd Expeditions of 1926, 1928, 1931, and 1933, particularly those of 1937 and 1938. Geographical surveys and geological observations were made in a number of the fiords of East Greenland by the scientists on the various expeditions. A submarine ridge discovered in $72^{\circ} 41' \text{ N.}$ and $2^{\circ} 55' \text{ E.}$ was named for Miss Boyd. In 1941 Miss Boyd led a government expedition to Greenland aboard the *Effie M. Morrissey*, commanded by Capt. Robert A. Bartlett. The scientists studied the layers of air to 300 m. altitude, made measurements of geomagnetism, auroral manifestations, intensity of ultra-violet light, and cosmic rays. The U.S. Coast Guard, the Carnegie Institution, and the National Bureau of Standards co-operated in the work of the expedition.

In 1936-37 the Norwegian Svalbard Expedition made 18 mapping flights and took 3,300 oblique photographs in West Svalbard covering about 40,000 square kilometers (15,400 sq. m.). In 1938 the Norwegians similarly surveyed King Karls Land. Extensive surveys were also made in Northeast Land by the Oxford Univ. Arctic Expeditions of 1935-36. These expeditions also did much geological, glaciological, and meteorological work.

Dr. Lauge Koch, leading a Danish expedition in May 1938, made photographic survey flights over Peary Land in northern Greenland.

In the Canadian Arctic, the Oxford Univ. Ellesmere Island Expedition (1934-35) made long exploratory sledge trips into Grinnell Land and Grant Land. Considerable astronomical, geological, and survey work was done by members of the expedition. Robert Bentham in 1936 continued the surveys in Lincoln Land, southern Ellesmere Island. The J.M. Wordie Expedition of 1937 charted about 600 m. of the northeast Baffin Island coast. The greater part of Southampton Island was mapped by the British-Canadian Arctic Expedition (1936-41), and T.H. Manning surveyed the Foxe Basin coast of Baffin Island in 1938-39.

During the summer of 1937, two nonstop flights from Moscow over the Arctic to the U.S. were completed. W. Tchkalov reached Portland, Ore., in 63 hours 25 minutes. M. Gromov landed at San Jacinto, Cal., after 62 hours 17 minutes of flight.

On Aug. 12, 1937, Sigismund Levanovsky with a crew of five left Moscow for Fairbanks, Alaska, flying over the North Pole. The plane was last heard from about 300 m. south of the North Pole on the Alaskan side and was presumably forced down. Search parties for the missing aviators were soon organized. Sir Hubert Wilkins with Pilots Herbert Hollick-Kenyon and Al Cheesman, men with much flying experience in both Arctic and Antarctic regions, made many search flights in the fall of 1937 and spring of 1938. The flights were made from Aklavik, Barter Island (Alaska), and Coppermine. These covered most of the Polar Sea north of the Canadian Arctic, in 44,000 m. of flying, but did not locate the lost aviators. They reported no land, although they examined from the air some 170,000 sq. m., of which 150,000 sq. m. were hitherto totally unexplored. This was an outstanding achievement in Arctic exploration and they saw a greater area of the Arctic than any other expedition up to that time.

A noteworthy venture in Arctic exploration was that of Wilkins with his submarine, *Nautilus*, commanded by Capt. Danenhöfer. They sailed to Svalbard and explored to $80^{\circ} 12' \text{ N.}$ and $1^{\circ} 30' \text{ W.}$, and then returned to Ice Fiord in Svalbard. Many depth soundings and other observations were made during 1931.

On Mar. 5, 1941, Ivan Cherevichney in the four-motored S.S.S.R.N. 169 flew from Moscow over the Kara Sea to Franz Josef Land, then via Severnaya Zemlya and the Novosibirsk Islands to Wrangel Island. From here they flew north and landed at $81^{\circ} 2' \text{ N.}$ and 180° E. on Apr. 3. Next they landed at 78° N. $176^{\circ} 40'' \text{ E.}$ on Apr. 13, and again at 78° N. and 170° E. on Apr. 22, where they stayed six days. Soundings and other observations were made at each station. On the return flight the plane left Wrangel Island on May 5, landed on Koteln Island, Cape Zhelaniya (northern end of Novaya Zemlya), then via Matochkin Shar Polar Station and Archangel to Moscow, arriving there on May 11.

On May 16-17, 1945, an R.A.F. Lancaster *Aries* flew from Iceland to the North Pole and back in seven hours. On May 26 this plane, on a technical investigation trip, with special magnetic instruments and observers, flew from Goose Bay, Labrador, and determined a new location for the north magnetic pole. It was placed 300 m. N.N.W. of the previously accepted position on Boothia Peninsula, and it was considered possible that there may be two areas in the north where the magnetic needle dips vertically. Latest studies place the north magnetic pole on the northern tip of Prince of Wales Island.

In 1946 the Soviet Acad. of Sciences announced that the zone of permanent polar frost is receding, permitting an increase in the area suitable for agriculture. A new "Cold Pole" was

claimed to have been located at Oimekov, Siberia, where temperatures of 94.4° below zero Fahrenheit have been recorded.

During 1947 a great increase in Arctic flying resulted in providing increased navigational aids, an improved mapping program and weather forecasting facilities in northern North America.

The war need for flying charts of greater accuracy was the direct cause of much photogrammetrical mapping in the Arctic. All of Alaska and large areas of Arctic Canada, including the southern half of Baffin Island, have been photographed by the Army Air Forces. The latest published charts show vast amounts of detail and are a great contribution to Arctic cartography.

U.S. army weather groups maintained meteorological stations and landing fields on the coast and ice cap of Greenland.

The Canadian military expedition, "Operation Musk Ox," using snowmobiles, traveled overland from Churchill via Baker Lake north to Victoria Island, then to Port Radium, the Mackenzie River, and south to Edmonton in the early spring of 1946. All types of specially designed equipment were tested under extreme winter conditions on this trek of over 3,000 m. in the Arctic.

See also *Arctic Regions*; *Arctic Sea*.

ANTARCTICA. Expeditions to the far southern waters were made as early as the 16th century, Sir Francis Drake venturing as far south as the tip of Cape Horn. Spanish, French, and Dutch expeditions followed, Yves Joseph de Kerguelen-Tremarec, a Frenchman, discovering (1772) Kerguelen Island in long. 70° E. and lat. 45° S. In 1772, the English outfitted two vessels, the *Resolution* and *Adventurer*, under Capt. James Cook, sending the expedition south to claim land for Britain. Cook sailed completely around the southern continent in a voyage daring and remarkable for those days of sailing vessels and imperfect navigation instruments. His farthest south was lat. $71^{\circ} 10'$, in long. $106^{\circ} 54'$ W. He had proved that Antarctica was an isolated land mass, not connected with any other. Sealing and whaling craft constituted the greatest number of vessels sailing in southern waters in the years that followed. The first definite discovery of Antarctic land was made by William Smith, an English merchant seaman, in 1819, when he sighted the South Shetland Islands (long. 60° W., lat. 63° S.), outposts of the continent farther to the south.

An English expedition led by Edward Bransfield followed Smith a year later to chart the South Shetlands and explore the waters around them. Bransfield claims to have sighted the Antarctic continent on this voyage, while exploring the strait between the islands and the mainland (Bransfield Strait). But his claim to this distinction has been disputed and it is possible that

what he thought was the mainland was actually Trinity Island (named Trinity Land by him) just north of the mainland. The sighting of the mainland in the same sector (1821) by Capt. Nathaniel B. Palmer, a New England sealer, is indisputable. In a voyage made some time later, Palmer explored the coast of the peninsula now known as Palmer Peninsula, reaching as far south as lat. 68° . A strange encounter on this voyage was his meeting with Adm. Bellingshausen, Russian navigator, who circumnavigated Antarctica, discovering Alexander I Land (long. 70° W., between lats. 70° and 75° S.) and Peter I Island (long. 90° W., lat. 68° S.). James Weddell, an English sealer, in 1823 penetrated to $74^{\circ} 15'$ S. in the sea which now bears his name, the farthest south up to then achieved. John Biscoe, an Englishman in the employ of the Enderby Bros., whalers, who considerably furthered exploration in the South Polar regions, became the first man to sight Cape Ann in the Indian Ocean sector (1831), finding Enderby Land (long. 50° E.). He also explored the region previously discovered by Palmer and Bransfield. Another Enderby sealer, John Balleny, one of the last of the sealer-explorers, sailed along the fringes of the Antarctic continent, discovering the islands now known as the Balleny Islands (long. 160° to 165° E. on the Antarctic Circle).

Four national expeditions followed almost simultaneously, those of the Frenchman Jules Sébastien César Dumont d'Urville, the Englishman James Clark Ross, and the American, Charles Wilkes. D'Urville explored the region of the Palmer Peninsula (1838) and failed in an attempt to penetrate the Weddell Sea. In a later voyage (1840), he sighted land at longitude 140° E., naming it Adélie Land. In 1892 the Norwegian sealer *Jason* under Capt. C.A. Larsen explored the east coast of Palmer Peninsula.

Charles Wilkes, an American explorer, was the first to prove Antarctica to be a continent. Setting sail in 1838 on a four-year voyage of exploration in the South Pacific, he traveled 1,500 m. along the Antarctic coast (between longitudes 155° and 100° E.).

James Clark Ross, an English navigator, made the discovery that opened the way for the South Polar expeditions of the last hundred years. Penetrating the formidable pack ice that bars the entrance to the Ross Sea (named for its discoverer), Ross and his men broke through into the open southern waters (Jan. 1841). Sailing southward, they came upon the great Ross Ice Barrier, a 200-ft. high cliff of ice stretching for 400 m. along the shores of the Ross Sea. Ross discovered here Mt. Erebus, the only known live volcano in Antarctica. On Jan. 24, 1895, Henrik Johan Bull landed at Cape Adare; he was the first to tread on the Antarctic continent. A Belgian



Courtesy Royal Geographical Society of Great Britain

MEDAL HONORING ROBERT F. SCOTT

expedition, led by Lt. A. de Gerlache, inadvertently became the first expedition to winter in the Antarctic ice when they were icebound, 1898. On this expedition were also Roald Amundsen and Dr. F.A. Cook (American). It was due to Dr. Cook's efforts that the expedition members survived the winter. Robert F. Scott, an English explorer, headed an expedition (1901-04), which discovered King Edward VII Land (longitudes 140° to 160° w.) and the Alexandra Mts. (longitude 160° E., latitude 84° s.); this was the first expedition deliberately to winter in these regions. Scott's party sledged southward to the Polar plateau, reaching latitude $82^{\circ} 16'$ s. Others of the party also made exploring trips inland and when Scott's ship sailed northward after two years of residence in the Antarctic, the men had amassed considerable geographical and scientific knowledge. Following Scott's first voyage, Sir Ernest Shackleton set out (1908) on the first assault on the Pole itself. Wintering on McMurdo Sound on the Ross Sea, he sledged to within 90 m. of the South Pole ($88^{\circ} 33'$ s.), being forced to return by exhaustion and lack of provisions. Shortly before this, Edgeworth David, of the Shackleton party, became the first to reach the vicinity of the south magnetic pole (about longitude 148° E., latitude 70° s.).

Roald Amundsen, Norwegian explorer, believed by many to have been the most efficient of all his colleagues, and the Englishman, Robert F. Scott, both established separate bases on the Ross Sea in 1911 (Scott on McMurdo Sound, Amundsen on the Bay of Whales) with the announced purpose of reaching the Pole. The Norwegian achieved this honor first, on Dec. 14, 1911, Scott following a month later, on Jan. 18, 1912. Amundsen's party returned safely to their base, but Scott and the three men accompanying him, bitterly disappointed, starving, and freezing, died on the trip back in one of the tragedies

of Polar exploration. In 1912, Filchner in the *Deutschland* explored the Weddell Sea and reached 76° s. 40° w. He extended Coats Land and discovered a large ice barrier that now bears his name.

Soon after the Scott disaster, Shackleton organized (1914) an expedition to base on the Weddell Sea from where he planned an 1,800-m. sledging journey to the Pole and across the continent to the Ross Sea. This plan never materialized, but the voyage was the occasion for one of the epics of South Polar annals. After drifting for about 1,500 m. in the Weddell Sea, and with almost 350 m. to travel to the nearest supply depot, Shackleton's ship, the *Endurance*, was crushed in pack ice (Oct. 1915), leaving 28 men (the entire crew was saved) and three boats adrift on an ice floe. They remained there at the mercy of arbitrary currents and winds, and constantly beset by great bergs and crashing pack ice, until March 1916, when they managed to steer a course toward Elephant Island, just north of Palmer Peninsula. From there, Shackleton and five men set out in a 22-ft. boat for the island of South Georgia, site of a whaling station 1,200 m. across the earth's most savage seas. After landing on South Georgia, Shackleton and two of the men traveled across the island in a near-miraculous journey of 36 hours to the whaling station on the opposite side. Every man of the crew was eventually saved.

In the years that followed World War I, a new era in Antarctic exploration opened up, for the use of the airplane in those regions was introduced. The first use of a plane in Antarctic exploration was by Sir Hubert Wilkins on the Wilkins-Hearst Expedition (1928-29). Wilkins flew from his base on Deception Island with C.B. Eielson as pilot on Dec. 20, 1928, for 600 m. s.w. along Palmer Peninsula and discovered and named Bowman Coast and Hearst Land. A year later Wilkins, with Cheesman as pilot, flew around Charcot Island on Dec. 29, 1929, and again saw Hearst Land. Sir Douglas Mawson of Australia wintered in Adélie Land in the 1930's, adding considerably to the knowledge of that region.

In combination with his whaling business, Lars Christensen also greatly extended geographical knowledge of the Antarctic. He sent out nine exploring expeditions. In 1926-27 the *Odd I* cruised in the vicinity of Peter I Island. During the seasons of 1927-31 the *Norvegia*, under command of Capt. Riiser-Larsen, circumnavigated Antarctica and discovered and named Queen Maud Land, Princess Ragnhild Land, Crown Princess Martha Land, and also smaller coasts to which Norwegian names were given. These lie between 17° w. and 86° E. In 1936-37, Christensen personally led an expedition aboard the ship *Thorshavn*, equipped



Official U. S. Navy Photo

U.S. NAVAL OPERATION HIGH JUMP, 1946

Icebreaker U.S.S. *Northwind* clearing a patch through the Ross Sea ice pack

with planes and modern scientific instruments. On this trip were also four Norwegian women, the first to voyage into the Antarctic. In a number of flights, 2,200 aerial photographs were taken with mapping cameras. This was the first large aerial survey in the Antarctic. During the various Norwegian expeditions over 2,500 m. of coast were delineated, half of which was photographed.

On the other side of the continent the British Graham Land Expedition of 1934-37, under leadership of John Rymill, did outstanding work. They surveyed much of the southwest coast of (Graham Land) Palmer Peninsula. They also discovered and mapped a great ice-filled depression which was named King George VI Sound. Lincoln Ellsworth of the U.S. in 1935, passed over this region on his transcontinental flight. Ellsworth flew (1935) from Dundee Island, after making two landings on the interior ice cap, to Little America, crossing an area which he named James Ellsworth Land. Ellsworth also led an Antarctic expedition (1938-39) to Ingrid Christensen Land which the Norwegians had explored in 1935 and photographed in 1937 (between long. 70° and 80° E.), claiming 77,000 sq. m. of territory there for the U.S. after a flight of about 210 m. to 72° S. and 79° E. over a region named by him American Highland. Capt. Alfred Ritscher of Ger-

many, using catapulted planes from the *Schwabenland*, made air survey of area between 12° W. and 20° E. On 16 flights 11,000 aerial photographs were made, covering about 135,000 sq. m. The territory was claimed for the Reich, though the region was previously claimed by Norway. The cruises of the Discovery Committee's Research ships *William Scoresby* and *Discovery II* have traversed the waters around the Antarctic Continent practically continuously since 1926. Their work in scientific oceanographical investigation is very extensive. The reports on marine biology and other subjects, though not yet all published, comprise some 24 large volumes.

Though farthest removed from the battlefields of World War II, the Antarctic also was the scene of action. The Norwegian whalers carrying on their usual activities during the season of 1941-42 were interrupted by an unknown German warship. On Jan. 14, 1942, the large factory ships *Ole Wegger* and *Solglint*, working near the ice edge, some five days steaming south of South Georgia, were captured by the German raider. See also *Antarctica*.

Under Rear Adm. Richard E. Byrd, U.S.N., Ret., four expeditions have journeyed south, each equipped with planes for exploration, etc. (1928-30, 1933-35, 1939-41, and 1946-47). On the first of these expeditions, Byrd established the famous base, Little America, on the Bay of Whales, Ross Sea. In November 1929, he flew over the South Pole, the first man to do so, as he had been the first to fly over the North Pole. But the principal value of these expeditions lies in the important geographical and geological information obtained. All of Byrd's undertakings have revolved around science, particularly geography, meteorology, magnetism, geology, biology, ornithology, ethnology, and glaciology. In addition he discovered and photographed hundreds of thousands of square miles of hitherto unknown areas. The first expedition saw the discovery of the eastern mountain range, named Edsel Ford Range, of the eastern shore of the Ross Sea, long sought after by explorers, and also to the east Marie Byrd Land. In 1939 in an expedition sponsored by the U.S. Antarctic Service, Byrd established two bases in the Antarctic, one near Little America, and another on Palmer Peninsula, from both of which parties were sent out to map the coastline. Byrd himself charted by plane 900 m. of hitherto unknown coastline.

In his fourth expedition, "Operation High Jump," undertaken in 1946 for the U.S. Navy, the largest expedition up to that time, Adm. Byrd tried to determine methods for training personnel, to test equipment, and to develop techniques for operating bases, all under Arctic conditions. The expedition was made up of 12 naval vessels and numerous aircraft. As an outcome of

this expedition, Byrd announced early in 1947 that a complete revision of all existing maps of Antarctica would probably be necessary; for instance, an area previously depicted as an ice-covered sea was really a mountainous region, and one area proved to be an "oasis" of unfrozen lakes.

In 1946 the British revealed that they had occupied a base at Marguerite Bay since 1943. Britain, Chile, and Argentina all claimed overlapping territory in this region. In 1947, Finn Ronne went to the Palmer Peninsula to continue surveys begun on his 1940-41 expedition. Ronne asserts that Antarctica is a single continent and not two great islands. Papers left by Adm. Peary on Cape Sheridan in 1905 were discovered in 1948 by a U.S. Navy task force sent to establish and supply weather stations at the Arctic and Canadian Archipelago.

Polaris (*pō-lār'is*). See *Polestar*.

Polariscope (*pō-lār'ī-skōp*), an optical instrument for examining substances in polarized light. The best known form is the Norrenburg polariscope. In this instrument the light is polarized by reflection from a plate of glass so mounted that it can be rotated to produce most effective polarization. For the analyzer a Nicol prism may be used to test the polarization. A platform is placed between polarizer and analyzer for mounting specimens.

Polarity (*pō-lār'ī-tē*), the quality of having opposite poles, or two points possessing contrary tendencies. A body such as a sphere cannot be said to have a polarity, since it appears similar from every point of view. However, if the spherical body rotates, it has poles at the opposite ends of the axis about which the rotation occurs. The earth is such a rotating body, which has north and south geographic poles at the extremities of the diameter. The poles of a magnet are opposite in attraction, and are called north and south from the way in which a freely suspended magnet aligns itself in the earth's magnetic field. The poles of a galvanic cell, called positive and negative, are the electrodes or terminals at which the positive and negative charges of electricity appear. Polarity exists in direct current circuits, negative (—) and positive (+). Alternating currents do not have steady polarity, as polarity changes rapidly, depending upon the frequency of the circuit. The property of acquiring polarity is termed polarization.

Polarization of Light (*pō-lār'ī-zā'shūn*), an asymmetrical condition applying to light which has been passed through certain crystals or has been reflected from nonmetallic surfaces at suitable angles. Ordinary light from the sun and other sources is symmetrical around every plane through the line of propagation. According to the electromagnetic theory of light, this means that the components of the electric and magnetic

fields are the same in every direction at right angles to the direction of travel. When, by reflecting the light or passing it through crystals, the electric and magnetic fields are constrained to oscillate in certain planes, the light is said to be polarized. Polarized light cannot be detected by the eye, but with a suitable analyzer the asymmetry can be detected by the change of intensity of the light when the analyzer is rotated.

There are several ways by which light may be polarized. Crystals such as tourmaline polarize light by absorbing the vibrations in one plane and transmitting those in a plane at right angles. This is called linear polarization. Light reflected from polished wood, glass, or water is polarized with the electric field vibrations confined to a plane perpendicular to the plane of incidence. Light which has been scattered or altered in direction is polarized. The light from the sky in a direction at right angles to the sun shows a strong polarization.

A simple experiment to illustrate polarization consists of cutting two thin slabs of the crystal tourmaline parallel to the axis of the crystal and mounting them so that they can be rotated. Light passed through them will be transmitted through both when they are parallel and will be stopped by the second slab when they are crossed. The first slab acts as the polarizer and renders the light asymmetrical by absorbing all the light except that vibrating in a single plane. The second plate acts as an analyzer or detector of the polarized light and allows light to pass only providing the slab is parallel to the first. Three different polarizations of light are possible: *circular*, *linear*, and *elliptic*. The direction of vibration of elliptic polarized light turns 360 degrees during one vibration; at the same time the intensity decreases and increases periodically. Circular polarization is a special case of elliptic polarization.

Polarized light was first observed by Erasmus Bartholinus of Copenhagen in 1669; he found that a crystal of calcite, known as Iceland spar, produced double refraction of the light with the result that anything viewed through the crystal appeared double. The two rays transmitted through calcite are polarized at right angles due to the crystalline asymmetry. William Nicol, in 1828, showed how the crystal of calcite, cut and cemented together with Canada balsam, might be used to produce or detect polarization. This device is known as the Nicol prism (see *Polariscope*). In the prism one of the rays undergoes total reflection at the layer of Canada balsam, so that the light which is transmitted is completely polarized.

Sir David Brewster (1781-1868) demonstrated that, when light is reflected from a nonmetallic surface, polarization is most nearly complete when the reflected ray and the transmitted ray

make a right angle to each other at the surface. The angle of incidence, known as the polarizing angle, for most nearly complete polarization by reflection from glass is 56° . The angle varies for different surfaces.

Polar Lights (*lits*). See *Aurora Borealis*.

Pole (*pōl*), either of the two extremities of the axis of a sphere, around which it rotates. The northern one of the earth is called the North Pole, and the southern is called the South Pole; each is 90° from the Equator. The term is applied in astronomy to the two points of the heavens that appear to be touched by the axis of the earth, and around which the heavens apparently revolve. These points are called the *celestial poles*, and, since no stars indicate their exact position, the polestar is reckoned from as the basis by the people north of the Equator. The term is applied in an enlarged sense to a line passing through the center of a great circle perpendicular to its plane. In this sense the *zenith* and the *nadir* are the poles of the horizon. A like application is made to the poles of a meridian and of the ecliptic. The term may be used in the same sense when speaking respectively of the celestial and terrestrial poles as the poles of the equinoctial and Equator.

In physics the poles are two points at which opposite quantities are concentrated, which are distinguished as *positive* and *negative*, as the two poles of a battery and the poles of a magnet. The magnetic needle varies 90° from a horizontal position at the *magnetic poles* of the earth. These poles have been variously located at different times. Latest research studies place them at 76° N., 102° W. in the Northern Hemisphere and at 68° S., 146° E. in the Southern Hemisphere. See also *Magnetism, Terrestrial*.

Polecat (*pōl'kāt*), a carnivorous mammal of the weasel family. It resembles the skunk in having glands that secrete a liquid substance with a disagreeable odor, which it ejects when scared or irritated. The polecat has a brown color and bears a valuable fur. Its body is from 15 to 20 in. long. The tail measures 6 in. and the body is about 7 in. high. It sleeps by day, but comes out at night in search of food, feeding on newts, mice, rats, frogs, birds, and poultry. Polecats are native to Europe and Asia. They are sometimes called *fitchet*, and their fur is termed *fitch*. The skunk of North America and the badger of South Africa resemble the polecat.

Polestar (*pōl'stār*) or POLARIS, also NORTH STAR, the principal star in Ursa Minor and the end of the handle of the Little Dipper. Its name comes from the fact that this second-magnitude star is situated within a degree from the celestial pole, the point where the earth's axis intersects the celestial sphere. It therefore remains nearly stationary in the course of the night and is of

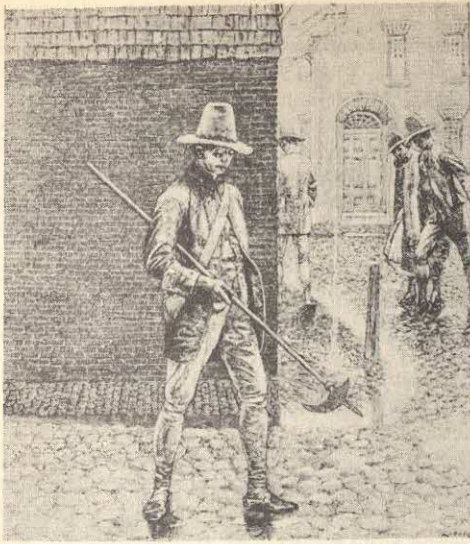
value to travelers in the Northern Hemisphere as a point for direction. It can easily be located since the two stars known as the pointers in the Great Dipper are in line with it. See also *Constellations; Dipper, Great and Little*.

Precession slowly changes the position of the pole among the stars. At the time of the Greek astronomer Hipparchus, Polaris was 12° away from the pole. Since then Polaris has steadily approached the pole and will be within less than half a degree from it around the year 2100, the separation increasing afterward.

Police (*pō-lē's*), a body of civil officers who are charged with the duty of maintaining order and enforcing the existing law of a community. The original policeman was a soldier and dates back to the Pretorian Guards of ancient Rome. In some countries a civil police is maintained as a general military organization, as the *gendarmérie* in France. The police systems differ widely in their organization and control as well as in the duties of their officers. In general, the police comprise officers maintained by the authority of towns and cities, each municipality having its own police administration. The police systems of Canada and the U.S. are quite similar to the form of organization maintained in many of the countries of Europe. However, in many countries the police force is more generally under the direction of states than in the American cities and the officers are often controlled more directly by the national government.

In former times European cities were entirely under the supervision of officers directed by the state or province, or this force was supplemented by a local police employed to patrol the city for the suppression of crime and the protection of life and liberty. This system was quite unsatisfactory, since the watchmen were inefficiently supervised by a local central superintendent. England had no modern police system until 1829, when Sir Robert Peel organized the metropolitan police for London, and since then the boroughs, counties, and cities have established similar local authority for municipal or district protection. The familiar names "Bobby" and "peeler" for English policemen are derived from their founder's name, Robert Peel. The policemen in all the larger cities may be distinguished by a particular uniform, but besides those employed as open peace officers, there are secret policemen, more commonly known as *detectives*, who are not uniformed. They are often referred to as "plain clothes" men, as are the non-uniformed investigators of the F.B.I. (*q.v.*).

There are state and local (town and city) police, and the various states in the U.S. have general power through the legislature to found and maintain systems of peace officers. Police regulations may be established by Congress sepa-



NEW YORK POLICEMAN OF 1693

ately, but this function is applied only to the army and during times of insurrection. The several states have provisions for maintaining peace officers in the townships and counties, but these are elected and remunerated by the people locally. In counties they are known mainly as sheriffs and in townships and towns, as *justices of the peace* and *constables*. The police officers proper are provided for by law as officials in organized towns and cities, and are usually appointed by the mayor with the approval of the city council, though in some cities the mayor appoints police commissioners.

Though the police systems of the large cities are somewhat differently organized and the duties of the various classes of police officers differ somewhat, in the main the regulations present the same general features. Cities usually offer training courses for their police staff and for new recruits, and maintain civil-service examinations for appointment and advancement. New York City, the largest municipality in America, is typical in the main features of its police system. Up to 1845 New York had the night-watch system as its main organization for maintaining the peace, but in that year an efficient police organization was established under a board of four police commissioners, and this was somewhat modified when Brooklyn became a part of New York. At present the police regulations are supervised by a Police Commissioner with five deputies and various branches. In addition to the Commissioner and his direct assistants, there is a well-organized office force, including clerks and stenographers. Specialized groups, such as the vice, narcotic, and homicide squads, are aided by the services of other specialists, including X-ray technicians, fingerprint experts, etc. Photographers are employed to make portraits of persons

POLITICAL OFFENSES

held on charges, and an adequate force of patrol sergeants and patrol policemen is on duty. The mounted policemen have charge of certain mobile functions, but the patrol car, in continuous radio contact with headquarters, has given greater efficiency and range to roving units. Police traffic regulation is another highly important service. They see to the enforcement of the general sanitary regulations. To facilitate the work of keeping the peace, they are assisted by a force of detectives, and they take care of men and animals that become disabled by accident or otherwise.

The general plan at present is to divide the larger cities into inspection districts, which are subdivided into precincts. Special policemen are put on for duty on particular occasions, as in the case of festivals and similar large gatherings of people. London has the largest police force in the world, followed by New York, Paris, Berlin, and Chicago. In most instances the number of policemen per 10,000 of population in the large cities ranges from 20 to 30. The total expense for police protection in New York is about \$65,000,000 per year. See *Federal Bureau of Investigation; Gestapo; Military Police; Scotland Yard*.

Police Court (*kōrt*), a court of record having jurisdiction over various minor offenses and the power to bind over for trial, in a superior court or for the grand jury, persons accused of more serious offenses. Its jurisdiction corresponds to that of the common-law justice of the peace.

Police Dog (*dōg*), the name applied to any kind of dog that has been trained for and is used in the police service. Among the best of these are the German shepherd dog, the Airedale terrier, and several species of bloodhounds. The best known of these are the police dogs of Germany, which are reared and trained in large numbers and widely distributed throughout the world. Police dogs are now used extensively in the larger cities of Europe and America.

Polillo (*pō-līl'yō*), an island of the Philippines, located off the eastern shore of Luzon. A number of other small islands lie adjacent to the coast. It has an area of 294 sq. m. and the group has 405 sq. m. Population, *ca.* 2,100.

Poliomyelitis (*pōl'i-ō-mī-ē-lī'tis*). See *Infantile Paralysis*.

Political Offenses (*pō-lī'ti-kəl ō-fēn'sez*), acts that are considered injurious to the safety of the state or nation, or which render a subject or citizen disloyal to the supreme authority. They include treason and any other acts of disloyalty and treachery intended to deliver the country or any part of it over to an enemy. In modern times nations have been lenient in dealing with political offenders, and usually they are not compelled to deliver them under extradition treaties. However, much severity has been practiced in authoritarian countries.

Political Parties in the United States, voluntary associations of citizens for united political action, usually designed to further the economic interests of a particular class, group, or section of the population. The political structure of the U.S. has operated against the growth of new or minority parties to such an extent that the history of American political parties can be outlined in three large periods, characterized by the struggles between (1) Federalists and Republicans¹ (1789-1816), (2) Whigs and Democrats (1830-56), and (3) Republicans and Democrats (1856-present).

Before the American Revolution and during that struggle, the two opposing groups, known as *Whigs* and *Tories*, did not operate in the modern sense of political parties. The Whigs favored severance of the ties that bound the colonies to England, while the Tories opposed independence. The issue, however, was decided by arms in favor of the former, and the republic was founded under the leadership of a small segment of the population consisting mostly of the agricultural aristocracy of the South, and the industrial and commercial leaders of New England. Washington was elected President on a nonpartisan basis. Gradually the issues began to crystallize between the Federalists and the Anti-Federalists, the former favoring the adoption of the Constitution with its clear advantage for the more populous states of the North. The leaders of both points of view, however, Hamilton and Jefferson respectively, held important posts in Washington's government. Following the adoption of the Constitution and the establishment of the Federal government, the Anti-Federalists took up the issues of *loose-construction* and *States' rights*, abandoned the name Anti-Federalist, and by 1792 had organized the Democratic-Republican party.

Foreign affairs, and especially the relations of this country with France, were destined to play a considerable part in the history of the first two parties. The French Revolution of 1789, which had won the support of the majority of the American people, soon developed into a French declaration of war against England and Spain. Anxious to obtain the assistance of the U.S., France sent to this country a number of aggressive ministers and philosophers in both official and unofficial capacities. Outstanding among these was Citizen Genêt who, by attempting to build a pro-French army in this country, alienated the people and the government to such an extent that the popular tide turned in favor of war with France. Large numbers of French and Irish immigrants (the latter even more violently anti-British than the former) helped sharpen the European issues and give to them a distinctly American

flavor. The Federalists, who then held power, were clearly identified with the pro-British, anti-French forces; Jefferson's new Republican party recruited all those who took the opposing view. Whatever their motives, the Federalists made the political error of enacting anti-French legislation in the shape of the Naturalization, and Alien and Sedition Acts of 1789. In reply, the Republicans drafted the Kentucky and Virginia Resolutions, proclaiming the unconstitutionality of these acts and hinting at secession or revolt. With the issues thus sharply drawn, popular sentiment took a definite turn away from the Federalists and toward the Republicans who now became the champions of free speech and liberty, the ideals of the not yet forgotten Revolution. The elections of 1800 carried the Jeffersonians into office and set the Federalists on the road to political obscurity and decay. For the next two decades, the Republicans held undisputed control of the national political stage, but thereafter the party split into factions over various domestic and foreign issues, and the election of 1824 turned into a five-cornered contest that was finally decided by the House of Representatives—the only case of its kind since the passage of the 12th Amendment to the Constitution—in favor of John Quincy Adams, leader of the *National Republican party*. In order to distinguish himself from the other collateral heirs of the Republican party, Andrew Jackson, vigorous campaigner and favorite son of the rugged, democratic west, entered the campaign of 1828 under the name of *Democrat*. Thus, despite the simple transposition of names, the Democratic party of today can trace its uninterrupted lineal descent from Jefferson's Democratic-Republicans of 1792. The National Republicans shortly adopted the name *Whig*, and continued the struggle for power up to the eve of the Civil War.

The period following the election of Jackson saw the introduction of an important device in the operation and maintenance of political parties. With the idea of rewarding his friends for their political aid, Jackson introduced the so-called "Spoils System" under which loyal party workers could expect to receive jobs and commissions in return for campaign service. Despite the moral issues involved in the Spoils System and its later effect upon Civil Service reform, all the major parties have since employed a substantially similar method of organizational control.

The election of 1832 brought into the field the *Anti-Masonic party*, a minority group constructed along strictly local issues and exploiting an almost extinct prejudice against secret societies. In 1826 a New York State bricklayer, William Morgan, had disappeared after revealing the secrets of his Masonic lodge. The finding of an unidentified

¹ Officially the Democratic-Republican Party, an outgrowth of the Anti-Federalists.

corpse in the Niagara River was converted into political capital and used to defeat political opponents who could be suspected of membership in the Masons. The short-lived Anti-Masonic party was sufficiently influential during its time to elect a few state governors. It was especially important as the first party organized around a single issue; thus, although it quickly disappeared, its adherents continued to be attracted to other single-issue parties such as the *Free-Soil party*, the *Know-Nothings*, and, ultimately, the Republican party.

Meanwhile, political action began to develop in still another significant direction. Although probably no more advanced than his British cousin, the American workman differed in the important respect that he had the right to vote. In 1828 the first labor party was organized by a number of Philadelphia craftsmen under the name of *Workingmen's party*. The issues motivating the party were political and social, having nothing to do with wages. One of the most pressing of these issues was the practice of imprisonment for debt: about 75 per cent of the occupants of New England's jails were confined for debts of less than 20 dollars.

Two historical factors, however, have operated against the growth of labor parties in this country. The open frontier, which maintained a state of geographical as well as social fluidity, prevented the crystallization of classes; moreover most high-caliber workmen, *i.e.*, potential political leaders, were able to rise above their class origins and were therefore rarely attracted to the idea of labor politics. The second factor was the Constitutional provision which effectively reserved labor legislation to the states and therefore rendered national organization impractical. Even if a labor party were to gain control of Congress, it would encounter great legal difficulties in effecting social or economic betterment—such as the invalidating decisions of the Supreme Court that set aside some of the early legislation of President F.D. Roosevelt's reform program. On the other hand, parties which operate only in states or municipalities can rarely achieve the prestige or influence necessary for continuous existence.

Other large issues, however, continued to attract men to politics; such was the abolitionist movement which encompassed many Northern humanitarians, and later businessmen and workers who came ultimately to agree with the statement of William Lloyd Garrison that no social progress is possible in a nation that keeps a sixth of its people in bondage. A converted slaveholder, James Gillespie Birney, was nominated in 1840 and 1844 for the Presidency by the *Liberty party*, which held its first convention in 1840. But much groundwork had still to be laid before

abolition could be achieved—by another party.

The Liberty party survived two elections before throwing in its lot with a group of New England Whigs and insurgent Democrats in the coalition known as the *Free-Soil party*. With Martin Van Buren as candidate, the Free-Soilers entered the election of 1848 under the slogan of "Free soil, free speech, free labor, and free men." Although it won no electoral votes, the party split the Democratic vote in New York, and gave the victory to the Whigs.

The election of 1854 produced at least two noteworthy parties, one of which has become a leading force in American politics. A large section of the population had long reacted to the influx of foreigners, all the more violently since many were Irish and German Catholics. The anti-immigrant, anti-Catholic sentiments of American Protestants were formulated by the *American party*, founded as a secret "Order of the Star-Spangled Banner." Its members responded to all outside questioning with the standard phrase "I know nothing," giving the party the popular name of "Know-Nothings." This party, however, quickly came under the influence of the Southern slaveholders, and its Northern section drifted to the more congenial and less ignorant atmosphere engendered by the newly formed *Republican party*.

The continued ineffectiveness of the antislavery forces, especially in the face of the Kansas-Nebraska Bill of 1854 which effectively nullified all anti-slavery compromises, made a new coalition inevitable. On July 6, 1854, a number of Whigs, Free-Soilers, and Northern Democrats convened at Jackson, Mich., declared the need for a Northern party, and revived the Jeffersonian name "Republican," which had been unused since the campaign of 1824. As an effective unit, the Republican party of today was formed at the Philadelphia convention of 1856 which nominated John C. Frémont as the party's first standard-bearer. In the campaign of that year, the "Black Republicans" polled 1,300,000 votes as against 1,800,000 for the victorious Democrat, Buchanan. Four years later, the party carried Lincoln to Washington.

The election of 1860 is important in history both for precipitating the Civil War and for establishing the two-party delineation which has persisted to the present time. Lincoln's victory on the Republic platform was due in large measure to the split within the Democratic party. Refusing to accept the extension of slavery, the Northern Democrats nominated Stephen Douglas, while the Southerners followed John Breckinridge of Kentucky. The *National Constitutional Union party*, attempting to ignore the issue that was tearing the country apart, placed Senator Bell of Tennessee in nomination. Douglas, competing

with Lincoln for Northern support, polled the second largest popular vote but gained only the smallest fraction of the electoral vote.

The following years of Civil War presented the issues sharply and left no room for new parties, or even for lesser issues within the existing parties. With the end of the war, however, and the resultant friction produced by Reconstruction, the political game was reintroduced. Because Gen. Grant and his conservative allies gained control of the Republican party, the more liberal and reforming elements cast about for a better vehicle than the old party provided. This they found in a rump movement known as the *Liberal Republican party*, founded in 1872. The Liberal Republicans, however, amalgamated too many discordant elements, and with the death of Horace Greeley, their first candidate, the party collapsed.

Still another party was born in the same election of 1872. Resting chiefly on a platform calling for the outlawing of intoxicating liquors, the *Prohibition party* came into being. In 1876, the *Greenback party* was organized at Indianapolis around a monetary plank designed to take up the postwar slack in agricultural prices by maintaining an expanded currency through the issuance of paper money or "greenbacks." A few years later, the Greenbackers threw in their lot with the Knights of Labor and the Farmers' Alliances to form the *Populist party* (or *People's party*) which, under the leadership of James Weaver and William Jennings Bryan, became an important force in American politics. The discovery of vast new deposits of silver led to a reduction in the market price of that commodity, and silver producers began frantically to demand that the government buy silver for coinage at a favorable price. Most of Europe, meanwhile, had adopted the gold standard. The U.S. had demonetized silver in 1873 when the metal was relatively scarce and silver producers could get better prices than the government would pay. With the drop in silver prices, however, the mine-owners discovered the "Crime of '73," and demanded the resumption of silver purchase by the treasury. Championed by the Populists, the issue of bimetallism became the dominant political question for the balance of the century. Although active as early as 1890, the Populist party was not organized until the following year, and entered its first major campaign in the presidential election of 1892.

Fifteen years earlier, the *Socialist Labor party* had made its first attempts at organization as a political trade union, but in 1892 it forcefully revived labor politics. By 1900, this party had given birth to an insurgent group known as the *Social Democratic party* which quickly outgrew the parent organization and the next year was

renamed *Socialist party*. Splits in the Socialist party gave rise to numerous left-wing groups, especially during and after World War I when the radical elements, favoring the tenets of the Russian revolution, formed the *Communist* and *Communist Labor parties*. The latter two consolidated (1924) to found the *Workers' party*, later adopting the name *Communist party* which it retained until 1944 when it was liquidated into the *Communist Political Assn.* However, in 1945 members voted to revert to party status once more.

Another, more indigenous, stem of American politics can trace its roots to a historic split in the Republican party. Opposing the conservative policies of President Taft, the *National Progressive Republican League* was founded in January 1911 under the leadership of Wisconsin's Senator Robert M. La Follette. In the debates that followed, former President Theodore Roosevelt supported the Progressives on many issues, and at the Republican convention of 1912 tried to unseat Taft and obtain the nomination for himself. Failing this, he bolted the party and accepted the nomination of the *Progressive* or *Bull Moose party*, which disappeared immediately after the 1912 campaign.

A movement of similar nature, however, was continued under the aegis of La Follette who, in 1924, called a *Conference for Progressive Political Action* which nominated a slate for the elections of that year.

Meanwhile, the *National Labor party* had been organized in 1919 and at a convention the following year had changed the name to *Farmer-Labor party*. Rejecting La Follette's candidacy in 1920, they altered their course four years later, expelled the radical wing and supported the Progressives in the national election. The Farmer-Labor party continued to exercise considerable influence in Mid-Western state elections, succeeding in winning several governorships and Congressional seats.

The politicalization of labor continued slowly for a period of years until two factors gave impetus to the movement. These were the formation of the Committee (later Congress) of Industrial Organizations, and the flowering of the "New Deal" under the first administration of President F.D. Roosevelt. Before the elections of 1936, the newly formed C.I.O. threw its strength into the struggle for the re-election of those candidates who had demonstrated an understanding for, and a sympathy with, the aims of organized labor. On a national scale, *Labor's Non-Partisan League* was formed to aid in the perpetuation of the New Deal. In New York State, this movement took the shape of the *American Labor party*; organized in the summer of 1936, the party polled a surprisingly large vote in November, and remained in existence un-

til 1956, with the aim of aiding labor's friends in political contests. Opposing what they termed "Communist domination" of the American Labor party, the right-wing section bolted, after losing control of the party in the 1944 primary elections, and formed the *Liberal Party* to participate in the Presidential elections of that year. A second A.L.P. split occurred in 1948 when a right-wing group resigned in protest against the left wing's support of Henry A. Wallace (*q.v.*) for President. Wallace was later the Presidential nominee of a newly-formed *Progressive Party*, but in August 1950, Wallace broke with the Progressives because they seemed to be following the Communist party line on Korea (*q.v.*). On a national scale, the A.F.L.-C.I.O. is active in politics but is nonpartisan. Its political work is carried on through the Committee On Political Education, and COPE activities are financed by voluntary contributions. See also *United States: HISTORY*.

Political Science (*pô-lit'i-kəl sī'ens*), the field of human knowledge that explores the origin of political authority, the exercise of political power, and the forms and structure of political organization and government, as well as the laws of political growth and development.

ORIGIN OF POLITICAL AUTHORITY: From the earliest days of recorded history, man has developed some form of organization whose purpose and aim are to maintain law and order within the group and to make decisions for the protection and defense of the group against its adversaries. Such an organization is called the state. The agency charged with the operation and control of the state is known as government (*q.v.*).

The reason why the people in the U.S. organized their government can be found in the preamble to the Constitution, which states: "We the People of the United States, in Order to form a more perfect Union, establish Justice, insure domestic Tranquility, provide for the common defence, promote the general Welfare, and secure the Blessings of Liberty to ourselves and our Posterity, do ordain and establish this Constitution for the United States of America."

In the U.S., political authority rests with the people, and the local, state, and Federal governments exist for the benefit and service of the people. Many of the individual's rights and liberties are enumerated in the first Ten Amendments, the Bill of Rights, to the Federal Constitution. State constitutions also include the concept of the Bill of Rights, and Federal and state courts can be called upon to protect the citizen in the exercise of such rights. See also *United States, Constitution of the*.

In a democracy, the individual enjoys freedom of speech, freedom of religion, freedom of the press, and freedom of association, *i.e.*, the right

to hold political and social meetings, to form labor unions or professional and fraternal organizations, and to organize political parties through which candidates for public office may be nominated, the final choice to be made by the people. Democracy is a way of life and a form of government which is based upon individual liberty. See also *American Way of Life*.

In an authoritarian country, the state is omnipotent, *i.e.*, all-powerful, exercising complete authority in all things. The individual has no rights except those which the state condescends to give him. This viewpoint dominates the Fascist and Communist countries, although their constitutions often refer to democratic institutions. See also *Communism; Fascism*.

In Soviet Russia and other Communist-organized nations, free speech is virtually, although not constitutionally, forbidden. Mass meetings are permitted only when organized by the government or the political party in power, *i.e.*, the Communist party. The press receives all news and its interpretations from the government. The ballot contains one name only—that of the Communist party candidate. The government and the party control all labor unions. Education is completely government-controlled, and the exercise of religion is strongly discouraged. A small group of men dominates the government and exercises complete power over the people.

Probably the most essential difference between the democratic and the authoritarian system, however, is that in the former the government acts independently of the political party in power while in the other system the party holds a veto power over government decisions.

THE EXERCISE OF POLITICAL POWER: The right of government to exercise power is called sovereignty (*q.v.*). In some countries, this right resides solely in the king, whose word is law. In a dictatorship, the sovereignty resides in one or a few ruling politicians. In the Western democracies, sovereignty resides in a duly elected government which is responsive and responsible to the people. This means that the people can change the rulings and decisions of government through the parliamentary procedures of passing new laws, amending constitutions, or electing new leaders.

FORMS OF POLITICAL ORGANIZATION: Political scientists classify governments as being one of three types. The oldest form of government is a monarchy or dictatorship, in which the governing power is exercised by one individual (*e.g.*, Louis XIV of France, George III of England, or Tito of Yugoslavia).

The second type may be an aristocracy, or that form in which the ruling power is vested in a few individuals who claim to possess certain aptitudes for its exercise (*e.g.*, the Medici family in



Courtesy The Bettmann Archive

BARON DE MONTESQUIEU

Florence, Italy). Many modern governments contain aristocratic elements within their structures today (e.g., in Spain).

The third form is a democracy, or that type in which political power is retained by the people. The people may exercise their governing power directly, as they did in the small republics of ancient Greece or as they do today in the cantons of Switzerland. Political power in a modern democracy is exercised indirectly, however, by means of electing representatives to executive and legislative positions, as is the case in the constitutionally organized states of Great Britain and the U.S.

Each of these forms of political organization, if brought into existence by the general will of the people, maintained by their consent, and employed for their benefit, is said to be a legitimate government. Each of these forms of government, however, is liable to a particular form of corruption. Monarchy or dictatorship has a tendency to degenerate into tyranny, or a government for the special benefit of a single ruler and his entourage; aristocracy may become an oligarchy, or the government by, and for the benefit of, a few of the ruling class; and a democracy can degenerate into mob rule.

ORGANIZATION OF GOVERNMENT: In 1748 Montesquieu, a French political scientist, published "The Spirit of Laws," which had a profound influence on political science. He pointed out that a good government should have three separate branches, the executive, or the law-enforcing agency; the legislative, or the law-making body; and the judiciary, or the law-interpreting body.

The most powerful executive in the world is the President of the U.S., who is commander in chief of the armed forces, signs all bills before

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they become laws, submits matters to the Congress for its consideration, and conducts foreign affairs. In most of the other modern democracies, the ruler or president is a figurehead. The executive power in such countries is exercised by the prime minister, or premier, whose tenure in office depends upon a majority vote in the legislature or parliament. In France, however, in 1958, a constitution was adopted which endowed the president with powers approximately the same as those held by the President of the U.S.

In the U.S. the President is advised by the various heads of the administrative departments of government such as the Secretary of State, the Secretary of Defense, etc., who make up the cabinet. These officials appear before congressional committees but do not participate in the deliberations of the Congress. In England the cabinet ministers may speak on the floor of Parliament. See also *United States, Departments of*.

The legislative, or law-making, branch of government usually consists of two houses, the upper and lower. In the U.S., the House of Representatives (*q.v.*) represents the people and has control of the purse strings. The Senate (*q.v.*), or upper house, represents the states. In Great Britain, the nobility is represented in the House of Lords and the people in the House of Commons (see *Parliament*).

The judiciary is charged with the responsibility of interpreting the Constitution, laws, and treaties of the U.S. The U.S. Supreme Court (*q.v.*) has the "right of judicial review." This fact was established by Justice John Marshall (*q.v.*), who ruled that the Supreme Court could, if the facts warranted it, declare a law passed by Congress null and void.

THE PARTY SYSTEM: The very foundation and essence of representative government are to be found in the process of electing public officials. The electorate, or body of voters, determines the form of government and also chooses those who guide and direct its public affairs.

The functions of the electorate are exercised through the process of voting; those who exercise this function are known as voters; the instrumentality through which it is exercised is the ballot; and the meeting at which it is done is the election.

In a democracy and a constitutionally organized state, the right to vote is an inherent right of each citizen by virtue of his membership in the state. Nevertheless, because the welfare of society is in large measure dependent upon the wise discharge of this function, the government confers the exercise of this function only on those who are believed fit and capable of discharging it. See also *Vote*.

To aid the people in selecting candidates for public office in a democracy, political parties have

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been organized. The U.S. and Great Britain usually employ the two-party system, although third parties may exist and participate in political affairs. In the U.S.S.R. and other Communist countries, only one party exists, and only one set of candidates, hand-picked by the party hierarchy, is submitted to the people for approval.

In France, political parties do not function on the local level as they do in the U.S. and Great Britain. A French political candidate seeks office on his own platform in his local district. If elected, he joins the party which is nearest to his own political point of view. This practice has resulted in the creation of many political groups in the French legislature and has frequently prevented stable governments. See also *Parliamentary Law*.

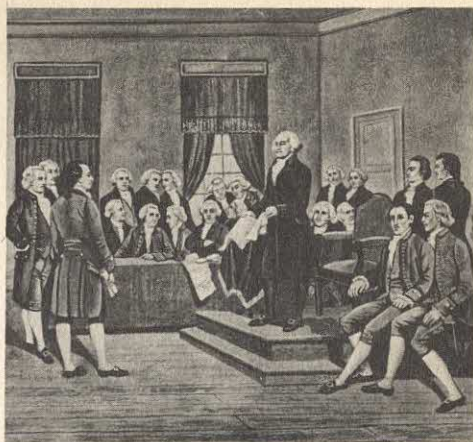
INTERNATIONAL RELATIONS: Political science is interested in the principles and practices employed by nations in their dealings with one another. The dominant principle governing foreign relations is the "idea of national interest." A country pursues that course of action which it believes is best for its own national self-interest. Such a course of action may be peaceful or warlike.

In order to reduce the friction between nations and hence remove the occasions for resort to force, independent political societies or states have developed a body of international law (*q.v.*) and set up a number of international organizations for the purpose of guaranteeing world peace.

International law attempts to regulate the rights, relationships, and obligations of nations with each other. In time of peace, every nation is bound to abstain from all interference with the dominions of other nations. In time of war (*q.v.*), nations are expected to refrain from (1) torturing prisoners, (2) poisoning wells, and (3) using inhuman instruments of war such as dumdum bullets. Moreover, flags of truce, agreements to exchange prisoners, and the work of the Red Cross (*q.v.*) and of the medical corps are to be respected by both sides.

The enforcement of international law depends upon world public opinion, the voluntary acceptance of law by nations, and the effectiveness of world organizations in the development and application of international law to specific problems. The International Court of Justice (*q.v.*) has jurisdiction over any question involving international law. The World Court, established by the League of Nations (*q.v.*), contributes to the development of international law through its decisions.

A new chapter in international law was written at the war-crime trials of German and Japanese leaders who were adjudged guilty in fomenting World War II (*q.v.*). The Charter of the United



Courtesy The Bettmann Archive.

THE CONSTITUTIONAL CONVENTION

George Washington addresses the delegates



Courtesy The Bettmann Archive

CONFERENCE AT GENEVA, 1864

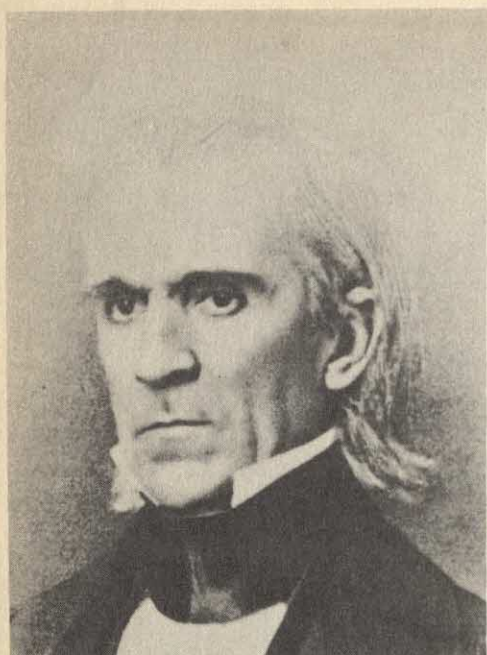
Out of these meetings grew the Geneva Conventions, establishing the Red Cross and rules of civilized warfare



Sovfoto

NIKOLAI LENIN IN MOSCOW

The first premier of the U.S.S.R. came to power in 1917, after the Bolshevik Revolution



JAMES K. POLK

Courtesy N. Y. Historical Society

Nations (*q.v.*) includes provisions for the progressive development of international law. See also *Germany*; *Japan*; *Nuremberg Trials*.

Frequently, regional agreements between nations are also employed to implement the effectiveness of international law in guaranteeing peace and security (*e.g.*, the North Atlantic Treaty Organization and the Organization of American States; see also *Pan-Americanism*).

The acute problems arising from modern colonialism are of concern to the political scientist. The industrial revolution created a demand for raw materials and overseas markets. The industrial countries of the world engaged in much competition for control of the underdeveloped areas of the world, particularly in Africa, the Near East, and the Orient.

The rise of nationalism and the desire for political independence on the part of the colonial peoples of the world, especially after World War II, have created serious problems for the colonial powers, such as Great Britain in India, France in Algeria, Belgium in the Congo region, and The Netherlands in Southeast Asia.

The U.N. established a permanent commission to aid the underdeveloped areas to achieve their independence, and several new countries (*e.g.*, Ghana) have recently been established and accepted as members of the U.N.

The space age presents many serious problems to political scientists of all nationalities. New concepts of international law and international organization are being devised in order to regulate and control the use of outer space; and

POLK

nuclear testing, control of atomic fall-out (*q.v.*), space exploration, and occupation of other planets will have an ever-increasing influence on the relations between nations. See also *Economics*.

Polk (*pōk*), FRANK LYON, lawyer, born in New York City, Sept. 13, 1871; died there, Feb. 7, 1943. A Yale graduate, he first became prominent as counselor to the U.S. Dept. of State (1915-18), then Under Secretary of State (1919-20), and head of the American delegation to the Peace Conference at Paris (July-December 1919). He later retired to private practice.

Polk, JAMES KNOX, 11th President of the U.S., born in Mecklenburg County, N.C., Nov. 2, 1795; died in Nashville, Tenn., June 15, 1849. Born of Scotch-Irish parents who moved to Tennessee in 1806, he studied at the Univ. of North Carolina and read law with Felix Grundy (1777-1840). Shortly after his admission to the bar in 1820, Polk entered the Tennessee legislature, where he became known as a competent man and a friend of Andrew Jackson (*q.v.*). Polk married in 1824 and went to Congress the next year. As chairman of the Committee on Ways and Means, he led the Jackson forces in their fight against the Bank (see *United States*), then served as Speaker during a time when the House was disordered by factionalism. His party drafted him to run for the governorship of Tennessee in 1839.

Although Polk was twice defeated for Congress, he retained his reputation for tact, good judgment, and hard work. When it became evident that Van Buren's opposition to the annexation of Texas would prevent his securing the two-thirds vote necessary for nomination, Jackson's influence helped make Polk the successful candidate.

As President, Polk displayed independence and energy. He refused to accept the guidance of William B. Lewis, Jackson's political adviser, and insisted that the members of his cabinet run their departments, not pre-convention campaigns. By winning reduced tariffs and re-establishment of Van Buren's Independent Treasury Bill (which had been repealed in 1841), Polk succeeded in giving the deathblow to Whig hopes for their program. In foreign affairs, Polk secured a compromise settlement of the Oregon (*q.v.*) boundary dispute with England by reasserting the American claim to the entire region when the British refused to accept the 49° line he had suggested as a compromise. Polk's attitude altered the stand of the British Foreign Office, and the compromise Polk had offered was accepted in 1846, with a slight deflection to give the entire island of Vancouver to Britain (see also *Fifty-four Forty or Fight*). With Oregon disposed of, Polk turned to his real interest, rounding out the U.S. by the acquisition of California (*q.v.*). He offered

Mexico \$20,000,000 and U.S. assumption of the debts Mexico owed to Americans in exchange for the territory, but the offer was refused. When Mexican troops crossed (Apr. 26, 1845) into what the U.S. claimed was Texas land, Polk found his diplomatic problem solved: Congress declared war and California was conquered. As Commander-in-Chief, Polk was harried by strong opposition in Congress and by the fact that the Army's top-ranking generals were Whigs. The war was denounced as a slave-owners' aggression against a weaker neighbor; supplies were delayed; Congress refused Polk's request that Sen. Thomas Hart Benton (*q.v.*) be made general of the Army to head the war. Victory in the field was followed by a treaty giving Mexico part of the payment she had refused for the land she was now forced to yield.

A competent, honest, painstaking man who disliked the Wilmot Proviso (see *Wilmot, David*) and John C. Calhoun (*q.v.*) with equal intensity, Polk refused a second term and was one of the first American Presidents to die exhausted by the cares of office.

Polk, LEONIDAS, clergyman and soldier, born in Raleigh, N.C., Apr. 10, 1806; died on Pine Mt., June 14, 1864. He was graduated from West Point Military Acad. in 1827, but resigned his Army commission and became a minister of the Protestant Episcopal Church.

In 1837 he was made missionary bishop in the southwestern part of the U.S., and three years later became bishop of Louisiana. He was strongly in sympathy with the secession movement, and at the beginning of the Civil War entered the Confederate army as major general. Distinguished services in the Battle of Shiloh caused Jefferson Davis to promote him to the rank of lieutenant general, and he received command of the armies of Kentucky and Tennessee. He commanded in the Battle of Chickamauga and was relieved of his command on the charge of disobeying orders, but received another command in December 1863. In 1864 he served with Gen. Johnston against Gen. Sherman at Atlanta, and was killed on Pine Mt. by the explosion of a Union shell.

Polka (*pōl'kă*), a dance of Bohemian or Polish origin, the name being derived from the Bohemian *pulka*, meaning half, or from the Polish *polka*, meaning woman. The dance, which originated in the 1830's, is characterized by small half-steps, with the music being written in two-four time, the first three quavers being generally strongly accentuated.

Pollen (*pōl'ēn*), a substance developed in the interior of the anther of a plant (see *Flower*). The pollen contains the male cells necessary to fertilize the female cells, or ovules, of the flower. When pollen is carried to the stigma of a blossom of the same species, it impreg-

nates the ovules, completing fertilization (*q.v.*). Germination (*q.v.*) follows, and the new plant is produced.

To the eye, pollen appears to be a fine yellow dust; under the microscope, its characteristic form may be observed. The most common forms of pollen grains are minute triangular or spheroidal bodies, but in umbelliferous plants they are oval, and in some compound flowers they are polyhedral. A pollen grain consists of two or three layers; within is a cavity, filled with a viscid fluid, which is sometimes transparent but usually is opaque because of the minute granules that float in it. Pollination, the process of bringing the male and female cells together, is usually effected by insects, the wind, or other agencies. When the pollen grain is lodged upon the stigma, the internal layer of the grain grows through the outer layer, forming a pollen tube, through which the male cell reaches the ovule of the stigma. The fertile seed (*q.v.*) results (see also *Cotyledon*).

Pollination (*pōl'ē-nā'shūn*). See *Flower*; *Pollen*.

Pollock (*pōl'lūk*), CHANNING, author and dramatist, born in Washington, D.C., Mar. 4, 1880; died Aug. 17, 1946. After a varied newspaper career, he began writing plays and musical comedy librettos. His works include "Ziegfeld Follies of 1915" and "The Grass Widow" (1917), both with Rennold Wolf; "The Sign on the Door" (1919), "The Fool" (1922), "The Enemy" (1925), "The Fool and Mr. Moneybags" (1928), "Harvest of My Years" autobiography (1943).

Pollock, SIR FREDERICK, journalist and author, born in London, England, Dec. 10, 1845; died in 1937. He was educated at Eton and at Cambridge and served as examiner of law at Cambridge from 1879-81. Subsequently he was professor of jurisprudence at Univ. Coll., London, and at Oxford Univ. He was professor of common law in the Inns of Court from 1884-90, and in the latter year was made a member of the royal labor commission. Besides contributing to magazines and encyclopedias, he published a number of important law and historical works. He is known to Americans through having been a long-time friend of Justice Oliver Wendell Holmes, Jr. (*q.v.*). This correspondence has been published as the "Holmes-Pollock Letters."

Poll Tax (*pōl tāks*), a tax levied on each poll or head, sometimes called capitation tax. It was levied at different periods in England, and in France until 1789. It was either a fixed general tax, or a graduated levy. It has also been called *poll-money*, *polling-pence*, and *poll-silver*.

In the U.S., a poll-tax is a state qualification for voting over which the Constitution has no authority. As a general tax, it was brought to the American colonies by the British in the

17th century, and was one of the grievances precipitating the Mecklenburg, N.C., Declaration of Independence (1775). Poll taxes tended to disappear after the Revolution, but were revived as a voting disqualification or restriction with the passage (1870) of the 15th Amendment, which extended suffrage to all citizens. In 1962 five states—Alabama, Arkansas, Mississippi, Texas, and Virginia—still levied poll taxes. In that year Congress passed a constitutional amendment to abolish the poll tax as a requirement for voting in Federal elections. If approved within seven years by the legislatures of 38 states, it will become the 24th Amendment.

Polo (*pō'lō*), a game resembling hockey, played in a field by men mounted on specially trained ponies, with mallets and a light wooden ball. It is the national game of the Balti race of Tibet, in whose language the name means "ball."

POLO SCENE

Persian miniature, 15th century

Courtesy Metropolitan Museum of Art, N. Y.



Although it may have originated in Persia before the Christian era, and was a common game among the Turks at Constantinople in the 8th century, it was not seen in the modern world until the middle of the 18th century. In 1854 it was introduced into Bengal from Manipur and was brought to England in 1869 by the 10th Hussars. America copied the game in the late seventies, and 1886 the first Anglo-American match was played. Since then, it has spread over the world and increased in popularity, but nevertheless has remained a rich man's sport.

Four men compose a side, or team, and play for 6 periods or "chukkers" of $7\frac{1}{2}$ minutes each. The field is 300 yds. long by 160 to 200 ft. wide; the uprights at each end are 8 yds. apart. To score, the players drive the ball between the uprights with long, flexible mallets. The ball is $3\frac{1}{4}$ in. in diameter, weighs $5\frac{1}{2}$ ounces, and is composed of willow root.

Polo, MARCO, traveler, born in Venice, Italy, about 1254; died there in 1324. He was the son of Nicolo Polo, an eminent merchant, who traveled extensively in Southern Europe and Western Asia about the middle of the 13th century. Later he sailed with his brother, Maffeo Polo, on a mercantile tour from Venice, and, after visiting Constantinople, they traveled in Persia, Central Asia, and China. In China they were favorably received by Kublai Khan, who manifested a keen interest in their accounts of European enterprise and commissioned them to visit the Pope at Rome. They returned to Venice in 1269 and two years later organized a second expedition, which was accompanied by Marco Polo. In 1275 they reached the palace of Kublai Khan and were again favorably received. This sovereign became greatly interested in Marco, since he showed remarkable aptitude in learning the Mongol language, and favored him with appointments on missions to the princes of adjacent countries. Later he became governor of Yangtchou, a province of eastern China, where he served successfully three years.

The three Polos escorted a Mongolian princess to Persia in 1292, but Kublai died while they were in Teheran, and they resolved to return home, reaching Venice in 1295. In 1296 Marco Polo took part in the great Battle of Curzola, in which the Venetians were defeated by the Genoese, and he was taken a prisoner to Genoa. While in confinement he dictated an account of his travels to fellow prisoner named Rusticiano, which was entitled the "Book of Marco Polo" and published in 1298. This work was received with much enthusiasm, but the minuteness with which the author described the wealth and beauty of China caused many scholars to regard it as fictitious. However, much of it was soon verified by Christian missionaries and it



TURTLES AND LIZARDS

1. Painted Turtle (*Chrysemys picta*) Eastern N.A. [6 in.] 2. Spotted Turtle (*Clemmys guttata*) Maine to Florida, west to Indiana [6 in.] 3. Leopard Tortoise (*Testudo pardalis*) Tropical Africa [18-24 in.] 4. Viviparous Lizard (*Lacerta agilis*) N. and C. Europe, Siberia [8-10 in.] 5. Gila Monster (*Heloderma suspectum*) deserts of S. Arizona and New Mexico [19 in.] 6. Collared Lizard (*Crotaphytus collaris*) Arkansas and Missouri to E. California [11-12 in.]



GIANT LIZARD AND CROCODILIANS

1. Komodo Lizard or Giant Monitor (*Varanus komodoensis*) Islands of Komodo and Flores, Dutch East Indies [12-14 ft. long] 2. Alligator (*Alligator mississippiensis*) from North Carolina, throughout Florida, and west to Texas [7-10 ft. long] 3. American Crocodile (*Crocodylus americanus*) extreme south of Florida, Mexico, C. America [12 ft. long]



MARCO POLO

German woodcut, 15th century

awakened intense interest in travel, thus leading the Portuguese to double the Cape of Good Hope and to reach Hindustan, while it aroused Columbus to seek a northwest passage and discover America. The "Book of Marco Polo" has gone through many translations and editions and is still a work of much interest.

Poltava (*päl-tä'vå*), or PULTOWA, a city in the Ukrainian Soviet Socialist Republic at the confluence of the Vorlska and Poltavka Rivers, 80 m. s.w. of Kharkov. Among the manufactures are cotton and woolen goods, machinery, clothing, and leather. It is the seat of several educational institutions, a cathedral, and a monument commemorating the victory of Peter the Great in 1709 over Charles XII of Sweden. It is surrounded by a fertile agricultural country and has an extensive trade in cereals, livestock, and lumber. The city was captured by the Germans early in World War II and retaken by the Russians in September 1943. Population, ca. 130,000.

Polyanthus (*pöl-ŷ-än'thūs*), a well-liked and widely cultivated kind of primrose with flowers about the size of the common primrose.

Polybius (*pö-lib'i-ūs*), Greek historian, born at Megalopolis, in Arcadia, about 204 B.C.; died about 122 B.C. He was instructed in the science

of politics and military arts by his father, who was a leading member of the Achaean League, and at the age of 24 years entered public life. In 168 B.C. war broke out between Macedonia and Rome and soon 1,000 Achaeans were summoned to Rome by commissioners to show why the Achaeans had not assisted in the defeat of Perseus, the King of Macedonia. Although most of this number were condemned to imprisonment, Polybius obtained permission to reside in Rome and while there formed a close friendship with Scipio Aemilianus. In 147 B.C. he accompanied that commander to Africa and the following year witnessed the siege and destruction of Carthage. Shortly after he returned to Corinth, which he found in ruins, and many of the fairest cities of Achaia were in possession of the Romans. He gained the gratitude of his countrymen by making favorable treaties with the Roman conquerors, and later many statues were erected to his honor. He wrote about 40 works on history, of which only five remain entire, while the others are studied from fragments or in extracts made from his writings. The principal work is his "History of Rome," in which he recounts the reasons why that country became powerful.

Polycarp (*pöl'i-kärp*), Christian father, born about 68 A.D.; suffered martyrdom about 154. There is no certainty as to the date or place of his birth, but it is thought that he was educated at Smyrna, where he probably formed the acquaintance of the apostle John. Irenaeus was his pupil at Smyrna, to whom the world is indebted for much information regarding Polycarp and the history of the church in the 2nd century. Some writers assert that Polycarp was appointed bishop by the apostle John, though this is doubted by others, but all agree that he was connected with the church from early manhood. He became the head of the church of Smyrna and gathered about him large congregations, to whom he related the accounts received from those who had seen Christ in the flesh. His reputation extended into Macedonia and other regions, and in the latter part of his life he undertook a journey to Jerusalem to visit Bishop Aincetus. On his return to Smyrna popular feeling against the Christians steadily increased, and after the festive games at Smyrna it was decided that Polycarp should suffer unless he would recant. The proconsul wished to save him, but he remained steadfast in the faith and was burned alive. His "Epistle to the Philippians" is the only one extant.

Polycletus (*pöl-i-klē'tūs*), sculptor and architect, lived in Greece between 460 and 400 B.C. He was a contemporary and competitor of Phidias (*q.v.*). His two most famous works were the "Doryphorus" (spear carrier) and the "Diadumenus," an athlete binding a ribbon of victory around his head. His statue of an "Amazon" is

also notable. We have Greek and, later on, Roman marble copies of all these and some other works of his. In his own time, his most admired work was a statue of Hera, executed in gold and ivory for the Temple of Argos, which was dedicated in 420. Though no longer extant, there are small reproductions of it on the obverse side of some contemporary coins. Polycletus tried to stabilize the ideal proportions of the human body and is said to have written a book about the problem of proportion, "The Canon." All of his figures show heavy, powerful forms, a clear development of the muscles, and natural movements.

Polycrates (*pō-līk'ra-tēs*), Greek tyrant of Samos, died in the latter part of the 6th century B.C. He was the son of Aeaces, and, taking advantage of a festival to Hera, made himself master of Samos in 536 B.C. After conquering several other islands and a number of towns on the Asiatic coast, he defeated the inhabitants of Miletus. His rule was eminently successful, since he gave much attention to the development of the arts and industries, and constructed many substantial and famous buildings. His navy included more than 100 ships, armed with 1,000 bowmen. Aristotle relates that he employed his subjects on vast public works to make them satisfied with his reign, and the splendor of his palace was such that Emperor Caligula rebuilt it many centuries later. He collected a library, encouraged learning, and promoted commerce. In 525 B.C. Polycrates formed an alliance with King Cambyses of Persia against Egypt, and sent 40 ships to promote an invasion of that country. However, the crew mutinied before reaching Egypt, and soon after returned to Samos. In 522 B.C., the Persian satrap of Sardis, Oroetes, enticed him to Magnesia, where he caused him to be crucified. Herodotus, the Greek historian, found many great buildings on Samos that he assigned to the reign of Polycrates.

Polygamy (*pō-līg'ā-mŷ*), the practice of plural marriage. Literally, the word *polygamy* means "many marriages," but actually it usually signifies the practice of having a plurality of wives (literally *polygyny*). The state in which a woman has more than one husband is more properly called *polyandry*. Polygamy is usually practiced only in those societies where, for some reason, there is an excess of one sex over the other over a long period of time, and it generally is confined, even in these societies, to the upper classes.

Many of the ancient nations of Asia and Africa sanctioned or tolerated polygamy as a religious institution, and it was practiced by the Israelites and the patriarchs, even under the Mosaic law. In the early history of Greece it had some foothold, but disappeared entirely as civilization progressed, and it was never sanctioned by the Romans and the Germanic races. *Monogamy* is en-

forced in all Christian countries. Polygamy never was generally tolerated or practiced in the U.S., although it was sanctioned for a period of about 50 years after 1843 by the founders of one branch of the Mormon Church in Utah. Congress passed a law punishing the practice in 1882, and in 1890 the Supreme Court upheld the constitutionality of the act, after which the head of the Mormon Church advised his followers to discontinue the practice, which had never actually been widespread.

Polygamy is still practiced in many countries of Asia and various islands of the Pacific, and is sanctioned in practice by the Mohammedans. Polyandry is practiced in some regions of Tibet, in Ceylon, and among certain races of Australia and New Zealand.

Polygnotos (*pōl-īg-nō'tūs*), Greek painter of the 5th century B.C., pupil of his father, the potter Aglaophon. As the most famous painter of his time, he was commissioned by Cimon, the head of the Athenian state, to co-operate in the rebuilding of Athens. Polygnotos executed various murals in the Poikile, an assembly room in Athens, in temples, and for the Propylaea (*q.v.*). His most famous painting was executed for the temple of the Knidians in Delphi. We have to rely on written documentation of these paintings, since no originals are preserved. Variations of his paintings, however, can be found on Greek vases. He obviously used perspective and, to a certain degree, differentiated between light and shadow. Among contemporaries and later generations Polygnotos was as highly praised as a painter as Phidias (*q.v.*) was as a sculptor. From the beginning of the 19th century archeologists tried to reconstruct his murals.

Polygon (*pōl'i-gōn*), a closed plane figure composed of straight line segments. The straight line segments are called the *sides*, the points at which the lines meet are called the *vertices*, and the entire bounding line is called the *perimeter*. The class to which a polygon belongs depends upon the number of its sides or angles. Those with three sides are called *triangles*; those with four, *quadrilaterals*; those with five, *pentagons*; those with six, *hexagons*; those with seven, *heptagons*; those with eight, *octagons*; those with nine, *nonagons*; those with ten, *decagons*, etc. A polygon is *equilateral* if it has equal sides, *equiangular* if it has equal angles, *regular* if it is both equilateral and equiangular, *convex* if each of its angles is less than 180°, and *concave* if one of its angles is greater than 180°. In elementary geometry the word polygon is usually understood to mean a convex polygon, and the area of a polygon is understood to mean the area within the polygon.

Polyhymnia (*pōl-i-hīm'ni-ā*), or *POLYMNIA*, in Greek mythology one of the nine Muses. She presided over rhetoric and the higher lyric poetry.

It is said that she invented rhythm and the lyre. She is represented in statuary in an attitude of meditation, the chin resting upon the right hand.

Polymer (*pōl'i-mēr*), in physics. See *Molecule*.

Polymerism (*pō-lim'ēr-iz'm*), a term (from the Greek words, *poly* and *meros*, meaning "many parts" or "many units") used in chemistry to indicate that substances may have the same percentage composition but different molecular weights. A polymer consists of many identical parts or *monomers* chemically combined to give a very large molecule. Examples are polyethylene or "polythene," represented by the formula $(C_2H_4)_n$, and neoprene $(C_2H_5Cl)_n$, where n is a very large number.

Polynesia (*pōl-i-nē'shī-ā*), a name usually applied to all of the islands in the Central and Western Pacific. These include, in addition to many smaller and sparsely populated islets, the two islands of New Zealand, the Hawaiian Archipelago, the Society and Marquesas, Cook, Tonga, and Samoa Islands distributed over 11,000,000 sq. m. of ocean. However, their combined area does not exceed 200,000 sq. m. and the population is not more than 1,800,000. Great Britain, France, and the U.S. hold practically all of the islands. The first extensive discoveries made were by Magellan, who visited the Ladrões and other islands in 1521. Three principal subdivisions are made of the whole group, embracing Polynesia Proper, Micronesia, and Melanesia, and each of these is again divided into smaller groups.

Polynesia Proper occupies the largest ocean surface and extends from below the Equator to regions far above it. The general direction of the islands of this and the other groups is from northwest to southeast. The inhabitants of these islands belong to the Polynesian race, though many different classes of people have formed settlements in various islands.

Micronesia is situated between the Philippines and the northern part of Polynesia Proper, while its southern boundary is formed principally by the Equator. The principal archipelagoes include the Carolines, Ladrões or Marianas, Marshall, Pelew, and Gilbert Islands.

Melanesia is situated northeast of Australia, south of Micronesia, and west of Polynesia Proper. It is the most important of the divisions, since it comprises the larger part of both the area and population. Among the most important islands of this group are New Guinea, New Britain, and the groups of Solomon, Loyalty, Chesterfield, New Caledonia, New Hebrides, Santa Cruz, Admiralty, and Louisiade Islands. There had been renewed interest in the northern part of this division before World War II, especially in the Bismarck Archipelago, where commercial developments had been undertaken by Australia, Holland, and Great Britain. Many of the islands and

island groups of Polynesia have very fertile soil, while all have remarkable uniformity in climate. Some are noted for valuable deposits of minerals. The islands are either partly or entirely of volcanic or coral formation.

Darwin and other writers express the view that this vast region was once a continent, and that the land became submerged below the surface of the ocean. This view accounts for the general trend of the volcanic islands, since they are regarded as the more elevated peaks of former mountain ranges. The coral islands have been built up by coral polyps as the surface settled farther and farther into the sea.

Most of the inhabitants are Polynesians, though there are many people of Malay origin. The languages differ widely, since various dialects are spoken in the separate groups, and the groups differ widely in the degree of social and industrial development they have attained. Christian missions were first established in 1797 on Tahiti, an island of the Carolines, and since then other missions have been established. The population of the islands has been gradually decreasing.

In former times the islands were richly endowed with commercially valuable forests, fruits, and, in the lagoons, large quantities of pearl and pearl shell. These natural resources have been greatly depleted, though considerable exports of copra and phosphates are still made. From 1938 until the outbreak of World War II, Tahiti's mining industry had been developed by French capital interested in its deposits of chrome, cobalt, nickel, iron, and manganese.

The products are diversified. They include principally fruits, coffee, coconuts, sugar, tobacco, cotton, rice, trepang, and cereals. Livestock is reared in abundance.

Most of the islands were taken by Japan early in World War II. The territory was recaptured by the Allies after bitter fighting from 1942 to 1945.

Polyp (*pōl'ip*), one of the many small aquatic animals, nearly all of which are inhabitants of the sea. Only two species of fresh-water polyps are known. They live largely in societies and include the corals, hydroids, and polyzoa. The body is cylindrical in form and has a mouth at one end, which is surrounded by a circle of arms or tentacles, in which respect they resemble the many-armed cuttlefishes. This class of animals belongs to the lower scale. They have none of the five senses common to other animals and are incapable of moving from their place. The coral polyps are perhaps the most interesting, since they are the builders of the coral islands.

Polyphemus (*pōl-i-fē'mūs*), a giant (*q.v.*) of Greek mythology, son of Poseidon and the nymph Thoösa, who is described as a one-eyed Cyclops (*q.v.*). He and other Cyclopes lived in caves in the

vicinity of Mt. Aetna, where he spent his life in herding flocks of sheep on the mountain side. Ulysses and his companions were stranded by a storm on the island of Sicily and were seized and confined in a cave by the giant. Polyphemus ate two of the Greeks the first day, and, after returning with his flocks at night, devoured two others the second day. Ulysses at length contrived to intoxicate the giant with wine brought from the ship and then destroyed the one eye of the giant with a heated olive staff. The giant, being unable to see, rolled the stone from the entrance of the cave, and, when he allowed his flock of sheep to pass out, the captives escaped in safety.

Polyloid (*pōl'i-ploid*). See *Diploid*.

Polytheism (*pōl-ī-thē'iz'm*), a religious concept which, contrary to monotheism (*q.v.*), supposes the existence of a plurality of gods. Many stages of polytheism are known. Beginning with fetishism (*q.v.*) in its most primitive form, it develops to a level whose main representation we know from Greek mythology. The next step of religious development may be found in Greek philosophical polytheism, as taught for example by Plotinus (205-270). Here the many gods become mere abstractions. Polytheism in the limited form of dualism (*q.v.*) is nothing more than the concept of two gods, or, rather, two divine principles. The great Asiatic religions such as Brahmanism (*q.v.*) are definitely polytheistic, attributing to the various gods specific qualities and functions. Here and in other polytheistic religions, the various divine personalities are merely abstractions of specific natural or spiritual forces. Pantheism, also opposed to monotheism, identifies God with all existing things and is therefore not at all identical with polytheism.

Pombal (*pōm-bāl'*), SEBASTIÃO JOSÉ DE CARVALHO, MARQUIS OF, statesman, born in Lisbon, Portugal, May 13, 1699; died in his castle of Pombal, May 5, 1782. He was descended from a noble military family, studied law at Coimbra, and in 1739 became minister to London. King John V made him ambassador to Vienna in 1745, but recalled him in 1750 to make him minister of foreign affairs. It was due to his efforts that the Inquisition was checked to a considerable extent in 1751. He improved the navy, the finances, and the police, and liberated the Indians of Brazil from slavery. He established elementary schools in Portugal, and in 1757 took effective steps against the Jesuits by requiring them to retire to their colleges. Two years later a plot against his life caused them to be banished from the kingdom. In 1777 Queen Maria I ascended the throne, and, as she was largely under clerical influence, Pombal was deprived of office and many of his reforms were set aside.

Pomegranate (*pom'grăn-īt*), a class of trees of the myrtle family. They are native to Palestine

and the Mediterranean region, but are cultivated extensively for their fruit in many countries. The tree is of small size, usually from 12 to 20 ft. high. It has shining leaves and twiggy branches and bears large and brilliant red flowers. The fruit is about the size of an orange. It has a hard, reddish-yellow rind enclosing many large seeds, each of which is enveloped in a red pulp from which a cooling drink is made. The rind and the flowers are used as a powerful astringent. Some countries have a brisk trade in the pomegranate, especially in the warmer climates, since it is a particular favorite as a cooling and refreshing fruit during the warm seasons. Its culture is most extensive in Southern Europe, Western Asia, Northern Africa, Mexico, and the West Indies. Several species survive the winters in latitudes as far north as Pennsylvania, but the fruit does not mature.

Pomerania (*pōm-ē-rā'nī-ā*), a maritime province of Germany, located in both the Polish Administration Zone and the Russian Zone of Occupation, bounded on the north by the Baltic Sea, east by Poland, south by Brandenburg, and west by Mecklenburg. It has an area of 11,665 sq. m. The soil is mostly fertile, although along the Baltic the surface is low and sandy. Forests are abundant and the province has a number of beautiful lakes. The drainage is principally by the Oder, Stolpe, and Persante. Among the minerals are bituminous coal and large deposits of peat. The fisheries are important. Vegetables, fruits, corn, wheat, rye, barley, oats, beet sugar, hay, potatoes, tobacco, live stock, and poultry are produced in abundance.

Railroad lines penetrate all sections of Pomerania. Before World War II, it had vast commercial enterprises, particularly at Stettin, the capital of the province and one of the chief seaports of Germany. The Univ. of Greifswald is the principal educational institution. Formerly the inhabitants were principally Goths, Slavs, and Vandals, and the province was named in the 5th century from a Slavonic tribe called *Pomerani*. It is mentioned in history in 1140, and shortly after it became a part of the German Empire. It was annexed to Sweden in 1637, but Prussia regained it gradually until the last Swedish possession was ceded in 1815. Prussia held it until 1919 when the Versailles Treaty gave part of it to Poland. In World War II, the province was captured by the Russian armies in early 1945. Population, ca. 2,000,000.

Pomeranian (*pōm-ēr-ā'nī-an*), sometimes wrongly called *Spitz*, a silky long-haired dog with pointed head, and small ears; of German or Italian origin. Also, a large dog related to the Eskimo dog, having a white coat and formerly used as wolf-hound.

Pomeroy (*pūm'ē-roī*), MARK MILLER, better known as Brick Pomeroy, journalist, born in El-

mira, N.Y., Dec. 25, 1833; died in Brooklyn, May 30, 1896. After elementary education, he entered the office of the *Corning Journal* as an apprentice printer, and later established a newspaper in Corning, N.Y. In 1857 he began the publication of the *Lacrosse Democrat*, but in 1868 founded *Brick Pomeroy's Democrat* in New York. This periodical became known for its sensationalism and attained an immense circulation. Politically, Pomeroy supported the Greenback party in the later years of his life. He resided for some time in Colorado, where he went for his health, and engaged in railroad and mine enterprises. He wrote: "Home Harmonies," "Brickdust," "Gold-dust," "Nonsense," and "Perpetual Money."

Pomona (*pô-mô'nà*), the Roman goddess of orchards and fruit trees, who is mentioned in legends as the wife of Vertumnus. The latter long tried in vain to approach her and finally did so in the guise of an old woman. Immediately he changed into a beautiful youth and soon wedded her. Ovid mentions her as the guardian of the boughs that bear the thriving fruit. She is represented in statuary as typifying autumn and assumes the form of a lovely maiden laden with branches of fruit trees. Some sculptors represent her holding a fold of her flowing garment filled with grapes and other fruit.

Pomona, a city in Los Angeles County, California, 32 m. E. of Los Angeles, on the Southern Pacific, the Atchison, Topeka & Santa Fe, and other railroads. The surrounding country produces cereals, citrus fruits and walnuts. Pomona Coll. (Congregational) is near the city, at Claremont. Among the manufactures are bread, canned fruits, earthenware, and machinery. The place was settled in 1875 and incorporated in 1887. Population, 1900, 5,526; in 1950, 35,405.

Pompadour (*pôn-pâ-dôor'*), JEANNE ANTOINETTE POISSON, MARQUISE DE, mistress of Louis XV, born in Paris, Dec. 29, 1721; died Apr. 15, 1764. She was the daughter of François Poisson, an officer in the household of the Duke of Orléans. A rich citizen named M. de Tournehen reared her, exercising great care in giving her a liberal and stylish education. Excelling in musical accomplishments and drawing, and having great personal grace and beauty, she soon charmed Parisian society. In 1741 she married Le Normant d'Etioles, through whom she became a queen of fashionable society. Louis XV met her at a ball given by the city to the dauphin in 1744. He at once became subject to her influences, and in 1745 she was established at Versailles. Louis XV bought her the estate of Pompadour, from which she secured the title of marquise (raised in 1752 to that of duchess). For 20 years the public affairs of France were largely in her hands. It had been the avowed policy of France to weaken Austria by courting the friendship of the German states.



MARQUISE DE POMPADOUR

Painting by M. Q. de la Tour (1704-88)

However, she soon changed this because Frederick the Great of Prussia had written satirical verses relating to her. An alliance with Austria, which she had helped form, finally brought on the Seven Years' War. Immense sums of money from the national treasury passed to the marquise, through which she obtained possession of land and other property. Though extravagant in the extreme, she encouraged poets and philosophers and patronized the "Encyclopedia."

Pompano (*pôm-pâ-nô*), or PALOMETA, a fish belonging to the horse-mackerel family. Preferring southern waters, the common pompano is found mostly in the Gulf and South Atlantic, but sometimes also along the Pacific coast. It is a popular sea-food dish.

Pompeii (*pôm-pă'yê*), an ancient city of Rome, located in Campania, at the foot of Mt. Vesuvius. It had a beautiful site on the Bay of Naples, near which the Sarnus River has its mouth, and in the time of the latter part of the republic and the early part of the empire it was noted as a favorite retreat and residence city of the wealthy Romans. The city was founded about 300 B.C. and became a Roman possession about 100 B.C. Under the Romans it was made a seaport and trade center of importance. Fine villas were built by noted military men and statesmen, among them Cicero. The Roman emperors, especially, aided the development of the city which was a summer resort for wealthy Romans. An earthquake visited it in 63 A.D., when many of its buildings were destroyed, but the Romans at once began to rebuild on a much grander plan, and within a few years it had a population of about 25,000. The calamity that finally destroyed the city occurred in 79 A.D., when great eruptions of cinders, ashes, and melted rocks burst from Mt. Vesuvius. This volcano had been inactive for ages, but when it suddenly broke forth on Aug. 24



Courtesy Ernest Nash, N. Y.

POMPEII. HOUSE OF THE FAUN, 2nd CENTURY B.C.

the accumulated force completely overwhelmed the people. For three days a continuous stream of lava flowed over the city, dense volumes of smoke obstructed the light of the sun, and the panic-stricken people were alarmed by repeated earthquake shocks that heaved and lowered the surface in consecutive waves.

Amid the fearful disturbance the citizens rushed rapidly from the city, but many were buried by the lava or suffocated in the gases that escaped from the burning mountain. The famous Roman historian, Pliny the Elder (23-79 A.D.), happened to be nearby with the Roman fleet; in order to save his friends and to watch the happenings he crossed the bay with some vessels and perished. His nephew, the Younger Pliny (61-113 A.D.), later related the accident and described the catastrophe in great detail. Both Pompeii and Herculaneum were destroyed, but the former was buried so deeply that all attempts to restore it were abandoned by Emperor Titus, who had organized commissions to relieve the sufferers and rebuild the city. At present the mass covering the city has an average thickness of 20 ft., but a part has been thrown from the volcano by subsequent eruptions. The city was entirely lost in the Middle Ages, partly because the Sarnus River had been turned from its course and the coast regions had been raised by the disturbance so the

site was more than a mile from the Bay of Naples. In 1748 the first discovery of the lost city was made by sinking a well in a vineyard of the vicinity. The workmen discovered a beautiful chamber containing statues and other productions of great beauty. Soon after extensive excavations began to be made and in 1755 the theater, amphitheater, and other buildings of historic interest were uncovered.

A system of excavations was promoted under the Italian government in 1760 for the purpose of restoring a large part of the statues and other valuable works of art. From then on the results of these excavations—the mosaics, the bronzes, and especially the painting—exercised a tremendous influence on the art of the last third of the 18th century and of the beginning of the 19th century. Art works from Pompeii were imitated so frequently that undoubtedly they strongly stimulated the development of the Empire style (*q.v.*). In the reign of Murat, from 1808-15, the Street of Tombs, the Forum, several public buildings, and a number of residences were excavated. Subsequently King Victor Emmanuel devoted public funds to promote excavations and secured many of the ancient works of art that may now be seen in the Italian and other European museums. The world reputation of the museum of Naples is essentially based on the works of art

POMPEY

from Pompeii which were transferred there. These excavations show that the city was built in the form of an oval, with straight and regular streets; some were not more than 15 to 20 ft. wide, though the principal streets had a width of about 30 ft. The streets were paved with blocks of lava. The houses were largely of concrete, though bricks were used in some structures, and many were from two to three stories high. Our knowledge of the Roman private house is based essentially on the excavations of Pompeii, since most of its houses were built following an identical scheme, more or less expanded. The houses represent a combination of the old Italian house with its rooms arranged around an "atrium" (an open courtyard) with the Hellenistic house with its peristyle (inner courtyard with columns). Most characteristic is the opening over the atrium through which not only this yard proper but all surrounding rooms also received air and light. In the center of the atrium was the *impluvium*, a basin for collecting the rain water. Among the most notable public buildings are the Temple of Mercury, the Pantheon, or Temple of Augustus, the Temple of Jupiter, the Temple of Venus, the Amphitheater, the Basilica, and the Curia. The private villas of Sallust, Marcus Lucretius, and Cicero have been located and a number of paintings and ornaments have been secured from them. Although it is known that more than 2,000 inhabitants perished in the catastrophe, only about 300 skeletons have been found. Their positions show the complete surprise by which they were caught, since some of them have their hands resting on doorknobs, etc.

What today is called "Pompeian style" is based on the numerous murals (see *Mural Painting*) which have been found in various houses. The style of decoration, which has been imitated so often, vacillates between full-fledged imaginative and realistic monumental paintings, and light decorations which imitate stage settings. The latter especially, with their perspectival deceptions and decorative ornamentations, were so gracious that till today they have been copied in mural paintings and wall papers, ever since about 1760.

Pompey (*pŏm'pē*), CNEIUS POMPEIUS MAGNUS, soldier and statesman, born 106 B.C.; died 48 B.C. He was the son of the Roman consul and general Cneius Pompeius Strabo, who had waged successful wars for Rome between 100 and 87 B.C., especially against Cinna and Marius. When Pompey was 20, he had fought at the side of Sulla (*q.v.*) against Marius. After he had led armies in Africa against the Numidians, he returned to Rome, had his first triumph, and was called by Sulla "*magnus*" (the great). Pompey continued fighting against the various revolutionary movements in Italy which tried to overthrow the constitution of Sulla. Returning to Rome he van-



POMPEY THE GREAT

quished the remainders of the revolutionaries of Spartacus, celebrated his second triumph in 72 B.C., and immediately became consul with Marcus Licinius Crassus (*q.v.*). He won tremendous popularity by introducing some democratic reforms to the constitution of Sulla. He was entrusted with leading the war against the pirates of the Mediterranean Sea in 67 B.C. and immediately fought against Mithridates (*q.v.*), King of Pontus, and Tigranes, King of Armenia. After all these wars, he returned to Italy and received a third triumph in 61 B.C. In spite of these honors, internal politics began to turn against him, and his foes in the senate, among them Lucullus and Cato (*qq.v.*), created great difficulties for him. This fact induced him to show his power by concluding the first triumvirate with Julius Caesar (*q.v.*) and Marcus Crassus. He married Caesar's daughter and ruled successfully together with Caesar and Crassus. After Crassus's death, rivalries arose between Pompey and Caesar which finally led to the outbreak of civil war in 49 B.C. This war was waged in Spain, Italy, and Greece; in the decisive Battle of Pharsalia (48 B.C.), Caesar conquered Pompey, who thereupon escaped to Italy but was murdered there.

Pompey's Pillar (*pŏm'pēz pil'ēr*), a celebrated column of red granite, standing on an eminence south of Alexandria, Egypt. It is built in the Corinthian order and may be seen about a quarter of a mile south of the walls of the city. The height is 98 ft. 9 in., the shaft comprising 72 ft. of this elevation, and it measures about 29 ft. in circumference. It is supposed to commemorate the conquest of Alexandria by Diocletian, in 296 A.D., and the Greek inscription at the base relates that it was erected by Publius, prefect of Egypt, in honor of that noted conqueror. A splendid circus and a forum were near this monolith in ancient times.

Ponca (*pŏng'ka*), a tribe of Indians formerly

in the territory now included in South Dakota and the northern part of Nebraska. They belonged to the Sioux family and spoke a dialect of the language used by the Osage, Kaw, and Omaha tribes. Lewis and Clark met with them near the mouth of the Niobrara in 1804, where they remained until 1877, when they were removed to the territory now included with Oklahoma. They are now settled in Nebraska and Oklahoma.

Ponce de León (*pôn'thâ dâ lâ-ôn'*), JUAN, Spanish explorer and conqueror, born at San Servas, Spain, in 1460; died in Cuba in July 1521. He was first engaged as a page at the Spanish court, and afterward served in the military forces sent against the Moors. In 1493 he accompanied Columbus on his second expedition to America. Soon after he commanded an army that conquered Puerto Rico, of which he became governor in 1510, but lost his position two years later. Though amassing great wealth, he lost his health and conceived the idea that a fountain could be found that would impart perpetual youth to all who would partake of its waters. In the Spring of 1513 he discovered Florida and landed a short distance north of the present city of St. Augustine. He returned to Spain in 1513, where he was appointed governor of the region he had discovered, and received equipment to conquer and

from 5 to 7 ft. long and 4 ft. wide. A hole in the middle enables the wearer to pass it over the head, and it hangs loosely before and behind, leaving the arms free. Ponchos of rubberized cloth are nowadays commonly used by soldiers and other outdoor workers such as forest rangers.

Pondichéry (*pôn-dê-shâ-ré'*), a port city and district, until 1954 a French possession, in India, 105 m. s. of Madras. The district is 115 sq. m. and is now in the state of Madras. The city is noted for one of the best anchorages on the Bay of Bengal and, having been the seat of the French government in India, has many public buildings, French and native colleges, and a cathedral. There are also steam and electric railway facilities. The chief manufactures of the district include cotton textiles, clothing, earthenware, bricks, and some machinery. There is considerable trade in oilseeds, cotton goods, sugar, rice, hides, and fruit. The French acquired the territory by purchase in 1674. In 1693-97 the Dutch held it, and from 1761 to 1816 it changed hands often between the British and French. French after 1816, in 1954 it was transferred to Indian sovereignty, ending a long-standing dispute between the French and Indian governments. Population, 1952, of the town, 58,600; of the district, 221,000.



PONCE DE LEÓN

colonize it. He landed in 1521, but was met by a hostile force of Indians, who killed a large number of his followers and drove the remainder back to their ships. Ponce de León was wounded by a poisoned arrow and soon after died from its effect.

Poncho (*pôn'chô*), an article of dress resembling a cloak, much worn by the Spaniards and Indians of South America. It is made of a rectangular piece of woolen or other cloth, usually



LILY PONS

Pons (*pöns*), LILY (ALICE JOSEPHINE), operatic soprano, born April 12, 1904, in Cannes, France. After studying piano at the Paris Conservatory, she began vocal training under Alberti di Gorostiaga and made her operatic debut in "Lakmé" at the Mulhouse (France) Municipal Opera in 1928. She won immediate success with her first U.S. performance, singing "Lucia di Lammermoor" at the Metropolitan Opera House, New York, in 1931. Thereafter she became one of the

Metropolitan's leading coloraturas and was widely known for her world concert tours and radio and film performances. Some of her noted roles were in "Lakmé," "Rigoletto," "The Barber of Seville," and "Le Coq d'Or." She was married to Andre Kostelanetz in 1938-58.

Pontchartrain (*pōn-chär-trän'*), a lake of Southern Louisiana, situated immediately n. of New Orleans, about 5 m. w. of the Pearl River. The length from east to west is 40 m. and the width is 25 m. Two canals connect it with New Orleans. It communicates through Rigolets Pass with the Mississippi Sound, thus facilitating transportation from New Orleans and the eastern part of Louisiana to the Gulf of Mexico. The lake is a favorite summer resort and many beautiful villas occupy the high and healthful banks on its northern shore.

Pontiac (*pōn'ti-āk*), chief of the Ottawas, an Algonquin tribe, born about 1712; slain in 1769. He was an Ottawa Indian, but gained influence as a leader of the Pottawattamies and Ojibways, and contributed largely to Braddock's defeat in 1755. His influence led to Pontiac's War, or Pontiac's Conspiracy (1763-64), during which he led the attack in the siege of Detroit. Forced to make peace with the British in 1766, he returned to friendly relations with them. He was killed at Cahokia, Ill., probably by a Kaskaskia Indian who was under the influence of liquor.

Pontiac, county seat of Livingston County, Illinois, on the Vermilion River and on the Gulf, Mobile and Ohio and other railroads. Pontiac is primarily an agricultural community, but has diversified industries, principally printing and the manufacture of shoes, heels, and light farm machinery. A branch of the state penitentiary is located here. Settled in 1837, the town was incorporated in 1872. Population, 1950, 8,990.

Pontiac, county seat of Oakland County, Michigan, on the Clinton River, 25 m. n.w. of Detroit. It is on the Grand Trunk R.R. Pontiac is first and foremost an industrial city—the home of Pontiac automobiles, General Motors trucks and buses, "Bodies by Fisher" and a host of other products covering a widely diversified field. Near Pontiac is Michigan's summer vacation land, an area containing some 400 lakes, full of game fish and offering all summer water sports, and skiing, skating and tobogganing in winter.

The famous Ottawa chieftain, Pontiac, after whom the city has been named, made his home here. On Mar. 28, 1820, the governor of Michigan issued a proclamation organizing the County of Oakland and fixed the seat of justice at Pontiac. The village of Pontiac was incorporated on Mar. 20, 1837, and became a city Mar. 15, 1861.

Pontiac has more than 20 public schools, a public library of about 35,000 volumes, and more than 85 churches. Population, 1950, 73,681.

Pontifex (*pōn'ti-fĕks*), the title given by the ancient Romans to members of one of the two celebrated religious colleges, the other being known as the Coll. of Augurs. Originally there were five pontiffs of this order of priests, the president being styled Pontifex Maximus, but the number was afterward increased to nine and still later to 15. The pontiffs were not charged with conducting sacrifices, nor were they obliged to worship any particular divinity, but they had general control of the official religion, and their head was the highest religious authority in the state, thus being neither subject to the people nor to the senate. Only patricians were eligible to membership in the Pontifex until 300 B.C., when the number was increased to nine under the Ogulnian law, and four of the pontiffs were selected from the plebeians. Tiberius Coruncanius was the first plebeian to be selected to the high dignity of Pontifex Maximus, being elevated to that position in 254 B.C. In 81 B.C. the number was increased to 15 by Sulla, and Julius Caesar added himself shortly after as the 16th, holding the position of Pontifex Maximus. With the beginning of the empire, the highest dignity was bestowed upon the emperor and the title passed in succession to the ruling sovereign. In the time of Theodosius the title became equivalent to Pope, and it is now one of the designations of the head of the Roman Catholic Church. The word pontifex is also used in liturgical works of the Latin Rite of the Catholic Church to designate a bishop.

Pontifical (*pōn'tif'i-kal*), a service book of the Roman Catholic Church, which contains rites and ceremonies pertaining to sacraments and public services. The pontifical now generally in use, commonly known as the "Roman Pontifical," was first published in 1485. It was revised in 1596 by authority of Clement VIII. The contents include prayers, ceremonials, and services for use in religious professions, ordinations, consecrations, benedictions, and sacraments. The "Ceremonials" is a similar service book, but is devoted particularly to ceremonials in vespers, mass, and other solemn offices. The learned Pope Benedict XIV is the author of the most prized edition.

Pontine Marshes (*pōn'tin*), a marshy region between Rome and Naples, stretching from Velitri to the sea and forming the southern part of the Roman Campagna. It is 26 m. long, varies in width from 4 to 15 m., and owes its existence to an obstruction of the streams rising in the Volscian Hills, due to elevated sand accumulating along the Mediterranean shore. Many attempts were made in ancient times to reclaim this marshy region, the first being by the consul Cornelius Cethegus in 160 B.C. Julius Caesar projected a system of complete drainage, but his untimely death caused his plans to remain unexecuted, and noth-

ing more was done until Pope Boniface VIII constructed a large canal and redeemed a region in the vicinity of Sezze. Other improvements were made in 1417. Pope Pius VI began a general system of drainage in 1678 and during the succeeding 10 years reclaimed a large part of the area, though much of it was given up as irreclaimable. In 1934 a modern drainage system was perfected. At present the region has many farms, while other portions supply fine pasturage for domestic animals.

Pontoon (*pŏn-tōon'*), in military engineering, a floating vessel supporting the timbers of a military bridge. Ordinarily, a number of pontoons are connected, thus forming a substantial support for a temporary bridge, which serves as a means for the safe passage of an army over otherwise impassable streams. The pontoons are boats, airtight metal vessels, wooden frames covered with India rubber, or other devices. Bridges of this character are of vast importance to a marching army and are usually transported by an organized train. See also *Bridge*.

Pontoppidan (*pŏn-tŏp'i-THän*), HENRIK, author, born in Fredericia, Denmark, July 24, 1857; died in Charlottenlund, Denmark, Aug. 21, 1943. He studied engineering for a short time in Copenhagen, but abandoned these studies before completing them. He also taught briefly in a high school, but after the publication of his first book, "Clipped Wings," a volume of short stories which appeared in 1881, he devoted his life to writing. His first novel, "Congregation at Sandinge," appeared in 1883. His three best known and most massive productions are the trilogy, "The Promised Land," which includes "Soil" (1891), "The Promised Land" (1892), and "The Day of Judgment" (1895); "Lucky Per" (1898-1905); and another trilogy, "The Kingdom of the Dead" (1912-16). Although the appearance of "Lucky Per" marked the height of his popularity and success, he continued to write until 1927, when he retired. In 1917, he shared the Nobel Prize for literature with his contemporary and fellow-countryman, Karl Gjellerup, "for his vital description of present-day life in Denmark." Pontoppidan's novels most frequently describe peasant life in his own country.

Pontus (*pŏn'tūs*), the name anciently applied to an extensive region in the northeastern part of Asia Minor, bordering on Armenia and Colchis in the east and extending westward to the Halys River. It included the regions north of the Anti-Taurus and Paryadres Mts., thus corresponding somewhat to the Turkish governments of Sivas and Trebizond. Pontus was governed by a Persian satrap until the conquest of Asia Minor by the Greeks. After the death of Alexander the Great, in 323 B.C., Mithridates II, a representative of an independent line of princes, came into pos-

session of the region. He was succeeded by a number of Pontine sultans, the most powerful being Mithridates VI, who successfully resisted Roman encroachment for many years, but was finally conquered in 65 B.C. by Pompey. Thereafter Pontus was divided, but the principal part was annexed to Bithynia. Pontus developed a high degree of civilization. Its people engaged in agriculture, commerce, manufacture, and fruit raising. The principal cities were Pharnacia, Trapezus, Cabira, and Amisus.

Pony Express (*pŏ'nĭ ěks-prĕs'*), an overland mail service between St. Joseph, Mo., and Sacramento, Calif. Begun in 1860, the mail route was covered in about ten days by expert riders on horseback. Regular pony express service was established with about 150 stations, 70 mail-carriers, and over 200 horses. Frequent Indian raids and bandit holdups rendered this period of American history a hazardous, although exciting, one. Before the pony express, letters to and from the west coast were delivered much more slowly by ship, stagecoach, or wagon trains. After the completion of the Pacific Telegraph Co. line in October 1861, the pony express service gradually diminished. See also color plate, *Communication I*, in Volume II.

Poodle (*pŏō'd'l*), a kind of small dog, distinguished by its long and curly hair. The head is high and round, the ears are long, and the legs are rather short. Large poodles are from 18 to 20 in. at the shoulders and are favorites among sportsmen as water dogs. They have a keen smell and remarkable power to trace the lost property of their master. Most poodles have a white or tan color, but black and mixed colors are well represented. Small breeds are favorites as lap dogs. All have an affectionate disposition.

Pool (*pŏōl*), a game played on a table similar to that used in billiards, but which has pockets at each corner and midway of two sides, into which the balls may roll in playing the game. The balls are numbered consecutively from 1 to 15 and are arranged in a form of a triangle at the beginning. The first player places the cue ball beyond the string line and drives it at the numbered balls, the object being to cause them to enter the pockets. If he fails to pocket one with the first shot, the next player drives the cue ball from where it stopped, and has the right to play until he fails to pocket a ball. The games played are quite numerous and are described in elaborate rules. Usually each ball counts one, so that the winner must pocket not less than eight balls, but in some games it is customary to count the numbers. In *continuous pool* it is required that balls be pocketed in consecutive order from the lowest number; that is, as numbered from 1, 2, 3, etc. See *Billiards*.

Poole (*pŏōl*), ERNEST, author, born in Chicago,

Ill., in 1880. After graduating from Princeton Univ. (1902), he moved to New York City where he engaged in writing magazine articles and fiction. During World War I he was a foreign correspondent in Germany (1914), France (1915), and Russia (1917). He held a similar post in England during World War II (1940-41). He died in New York City, Jan. 10, 1950.

In addition to the plays, "None So Blind" and "A Man's Friends," he wrote many novels, including: "The Harbor" (1915), "His Family" (1917) which won the 1918 Pulitzer award, "Beggars' Gold" (1921), "Millions" (1922), "One of Us" (1934), "The Bridge: My Own Story" (1940), "Giants Gone" (1943), and "The Great White Hills of New Hampshire" (1946).

Poole, WILLIAM FREDERICK, librarian and bibliographer, born in Salem, Mass., Dec. 24, 1821; died Mar. 4, 1894. He was graduated from Yale Univ. in 1849, and while in his junior year prepared the first edition of "Index to Periodical Literature," which he revised and enlarged from time to time. In 1851 he was chosen assistant librarian of the Boston Athenaeum and became principal librarian in 1856. He held like positions in Cincinnati and Chicago in subsequent years, serving as librarian of the Newberry Library in Chicago from 1887 until the time of his death. Poole was president of several associations, including the American Historical Association and the American Library Association. He edited the *Owl* in Chicago and published "Mather Papers," "Orthographical Hobgoblin," "Battle of Dictionaries," and "Salem Witchcraft."

Poona (*pōō'nā*), or PUNA, a city of India, in the central division of Bombay, about 80 m. s.e. of the city of Bombay with which it is connected by railroad. It is 1,850 ft. above sea level. Among the chief public buildings are the Deccan Coll., a public library, an arsenal, several colleges, a teachers' training school, hospitals and a number of churches and temples. It has manufactures of cotton and woolen fabrics, jewelry, ornaments, silk, and utensils. Poona is the military station for a large region of India, and north of the town are barracks and military hospitals. The inhabitants consist largely of Brahmans. It was formerly the capital of the Mahratta princes, but was annexed in 1818 by Great Britain. Population, ca. 250,000.

Poor (*pōōr*), HENRY VARNUM, artist, born Sept. 30, 1888, at Chapman, Kan. He was educated at Stanford Univ. and then went abroad to study art at the Slade School in London and the Julian Acad. in Paris. On his return to the U.S. he taught art at Staford Univ. Until 1931 he devoted himself largely to ceramics; among his most notable projects in that field was a ceramic ceiling which he made for the Union Dime Savings Bank in New York City. In 1931 he had his first



Courtesy Frank K. M. Rehn Gallery, N. Y.

HENRY VARNUM POOR

Self-portrait

one-man show of paintings and after that time turned chiefly to painting. He was chosen to paint 12 mural panels in fresco for the U.S. Dept. of Justice Building in Washington and he also painted a large mural for the Dept. of the Interior Building entitled "Conservation of American Wild Life."

Poore (*pōōr*), BENJAMIN PERLEY, author and journalist, born in Newburyport, Mass., Nov. 2, 1820; died in Washington, D.C., May 30, 1887. After attending public schools, he became an apprenticed printer and in 1838 began editing the *Southern Whig* in Atlanta, Ga. In 1841 he visited Europe and served in an official capacity with the American legation at Brussels. On returning to America, in 1848, he was made historical agent for Massachusetts, collecting 10 volumes of valuable matter from the archives in France, and in 1851 became editor of the *Sunday Sentinel*. He was appointed clerk of a Senate committee in 1854 and later secretary of the U.S. Agricultural Society, and became editor of the *Congressional Directory* in 1867. His writings cover divers subjects. In 1855, he compiled a catalogue of publications issued by the U.S. from 1774 to 1881.

Poor Laws (*pōōr lās*), legal enactments which provide for the collection and disbursement of funds for the maintenance of those lacking the means of subsistence. All the nations have made provision for supporting those who are unfortunate and without means of support, and have usually regarded none so indigent or wretched as to refuse to supply them with the ordinary necessities of life, such as shelter, clothing, and food. See also *Social Work*.

AMERICA. The support of the poor in the U.S.

is left directly to the several states. As a rule the legislatures have established institutions for the maintenance of the dependent and helpless. Formerly the poorhouse was the common receptacle for all the unfortunate and indigent, from the fatherless infant to the idle beggar. At present there are adequate provisions for the defective, dependent, and indigent of all classes, and many of the institutions possess training and educational features. The system as a whole includes separate schools for the idiotic and feeble-minded, the deaf and dumb, the blind, the insane, the children of dependent parents, the incorrigible children, and those who are neglected. See also *Social Security*.

Poosepatuck (*pōōs'pā-tūk*), the modern name for a remnant of the Long Island Indian tribes, principally Uncachogue, located on a small state reservation at Mastic Neck, Long Island, New York. They are much mixed with Negroes, live in poor shacks, and make difficult livings as laborers. There were 34 of this tribe in 1930, as against 18 in 1915.

Popayan (*pō-pā-yān'*), a city of Colombia, capital of the state of Cauca, on the Cauca River, 225 m. s.w. of Bogotá. It is surrounded by an elevated but fertile plain. It was the center of great commercial life until 1834, when an earthquake nearly destroyed it, but it has since developed considerable enterprise. Popayan is the seat of a university, contains a cathedral and a hospital, and has a number of beautiful public and private buildings. The manufactures consist chiefly of machinery and woolen goods. A commercial road extends from it to Truxillo, Peru. The place was founded by the Spaniards in 1537. Population, ca. 22,000.

Pope (*pōp*), a title applied originally to any bishop of the Christian Church, but later to the patriarch of Alexandria, and now to any priest of the Greek Church and (since 1076) in the Roman Catholic Church to the Bishop of Rome. The word is derived from the Latin *papa*, meaning "father," in the narrower sense of the word the father of Christianity.

This article treats particularly of the Roman Catholic Pope, who is the supreme pontiff and visible head of the Roman Catholic Church. He is regarded by that church as the vicar of Christ and the successor of St. Peter (see *Keys, Power of the*). To gain this authority a long struggle had developed between the Eastern and Western churches for superiority, but the tradition that the apostle Peter founded a church in Rome and afterward suffered martyrdom there gave the Western church pre-eminence.

Emperor Valentinian III issued a decree, in 445, recognizing the Bishop of Rome as primate, but for more than 300 years papal measures met with violent opposition. The division of the Eastern and Western churches in 1054, known as the



Courtesy Bettmann Archive, N. Y.

BLACK SMOKE RISING FROM THE CONCLAVE WHICH ELECTED POPE LEO XIII IN 1878

The tradition of burning the ballots used in the election of a new pope dates back to at least the 13th century

Greek and Roman Churches, ended the contention between the two bodies.

From the point of view of the Church, the owner of Peter's See, the seat of the Bishop of Rome, always had the qualities of primacy, infallibility (*q.v.*), and the power of the keys. Even the earliest of the Church doctors recognized these qualities, except for the leaders of a few minor sects such as, for example, the Montanists under Tertullian (*qq.v.*). Irenaeus, who lived in the 2nd century A.D., was the foremost of the church doctors in explaining the supreme importance of the Pope. He explicitly states that the doctrines taught at Rome represent the absolute truth.

Temporal power of the Pope, though previously claimed, was not fully established until 754, when Pepin, King of the Franks, recognized such authority. In 774 Charlemagne confirmed the temporal power of the Pope and enlarged his dominion, and Princess Matilda, daughter of Duke Boniface of Tuscany, made the Holy See heir to her extensive possessions in 1076. For many years powerful contentions between the states of the Church and the rulers of Europe were common.

During the Middle Ages, the Pope was often chosen solely for politically expedient reasons through the influence of, for example, the German

POPE

emperors or the Roman nobility. Once in power, however, he became the absolute ruler of the Church, although political dissidents sometimes simultaneously elected antipopes. Since the 11th century, the power of selecting the Pope has been vested in the College of Cardinals, which usually chooses one of its own number. Sometimes the elections were held years after the death of a Pope, but since the time of Pius XI the Assembly of Cardinals must meet at the latest 20 days after the death of a Pope. Often many ballots are necessary before the prescribed unanimity is achieved.

The rise of Protestantism under Luther caused the Pope to lose fully one-half of Europe and this loss was never regained. When the Thirty Years' War was ended with the Treaty of Westphalia in 1648, religious tolerance was established or foreshadowed in all the countries of Europe, and the papal revenues not only decreased, but the bulls issued from Rome no longer had material effect outside the states of the Church. Conditions were soon brought about that made the decline of temporal power rapid.

When the Franco-Prussian War began, in 1870, Napoleon III was obliged to withdraw French troops from Italy. This circumstance was taken advantage of by Victor Emmanuel II, King of Italy, and on Sept. 20 of that year he entered Rome. Subsequently, being stripped of all temporal power, the Pope lived in seclusion for several decades. His influence in spiritual matters, however, was in no wise interfered with.

On July 18, 1870, the Vatican Council, in the bull "Pastor aeternus" decreed that the Pope has supreme power in all matters of faith and discipline pertaining to the pastors and the faithful, and proclaimed that he has infallibility by divine assistance when, in his apostolic office—i.e., speaking *ex cathedra*—he defines a doctrine of faith. Contrary to widespread belief, private and casual opinions of the Pope are not considered infallible. "Ex jure divino" (by divine right), therefore, the Pope has complete jurisdiction over every believer and over the Church as a whole. Thus, every priest, even archbishops and cardinals, is responsible to him.

The seclusion of the Pope was ended in 1929, when Pius XI signed a treaty with Italy. Since then, the Pope, no longer a "prisoner of the Vatican," has lived in official agreement with the Italian government. The present Pope (elected in 1958) is John XXIII (*q.v.*). See also *Roman Catholic Church*; *Saint Peter's Church*; *Vatican City*.

Pope, ALEXANDER, poet, born in London, England, May 22, 1688; died May 30, 1744. He was the son of a wealthy Roman Catholic merchant, who spent the latter years of his life at a rural home near Windsor. Pope engaged in study from an early age and at 12 wrote his "Ode to Soli-



A. POPE

tude." Later he was sent to school at Twyford and London, where he became a proficient scholar in Greek and Latin. His stature was so small that he needed a high-chair at the table and his physical strength was so greatly impaired that he was frequently unable to dress or undress himself. In order to regain his health, he roamed about the fields in his youth and there developed the love of nature which plays such a large part in his writings.

While he was still a boy, he translated works of Ovid and later he translated Homer, although in a rather colorless manner, which largely missed the original power and intensity of feeling. It is interesting that his feeble translations of the "Odyssey" and the "Iliad" brought him \$30,000, a financial success never attained by any other writer of the 18th century. His own works were, quite naturally, strongly influenced by his preoccupation with the ancients. When he was 16, he published "Pastorales," and later on, special poems about Windsor Forest, etc. His poetical principles were expressed in his didactic poem, "Essay on Criticism" (1711), which gives us a complete picture of the aesthetic doctrines of his time: "Learn hence, for ancient rules adjust esteem; to copy nature is to copy them." As during his lifetime, the aesthetic ideas of antiquity were identified with the return to nature, it is not surprising that he, with his intellectualism, had no feeling for the elemental power of Shakespeare, whom he edited in 1721. Criticism of this edition brought him into many arguments with contemporary literary men, whom he attacked in a famous satire, "The Dunciad" (1728-43).

In 1733, he published his "Essay on Man," a work in four epistles. The first treats of man in his relation to the universe; the second, of his relation to himself; the third, of his relation to society; and the fourth, of his ideas of happiness. His most famous poem, the comical epos, "The Rape of the Lock" (1712), is a parody of the heroic epos of the time, full of witticisms and subtleties. While many others of Pope's works are no longer interesting aside from the fact that they mirror the general taste of the time, "The Rape of the Lock" remains enjoyable reading today.

The importance of Pope cannot be overestimated. He expressed exactly the two main intellectual and spiritual tendencies of his time: the sentimental approach to nature and the interest in the literature of the ancients.

The fact that Pope also dabbled in painting is not generally known. His self-portrait shows his feeble, pygmylike figure before a pompous background of ancient ruins, perhaps a commentary on the fact that it was erudition more than original poetic power which inspired his works.

Pope, JOHN, soldier, born in Louisville, Ky., Mar. 16, 1822; died at Sandusky, O., Sept. 23, 1892. He was graduated from the U.S. Military Acad. in 1842 and was appointed lieutenant of engineers in the U.S. Army. While holding that position he served on the survey of Florida, on the northwestern boundary, and in the Mexican War. He was promoted for efficient services at Monterey and Buena Vista to the rank of captain, and aided in making the government surveys in North Dakota and New Mexico until the beginning of the Civil War. In the early part of 1861 he became brigadier general of volunteers, and in December of the same year defeated the Confederates under Gen. Price at Blackwater, Mo. The following spring he captured New Madrid, in the same state, and Island No. 10 in the Mississippi River. He was thereafter transferred to the East, where he was given command of the Army of Virginia, which had been under Gens. McDowell, Frémont, and Banks. They had been defeated by Stonewall Jackson, and after a vigorous campaign Pope was defeated on Aug. 29-30, 1862, in the Second Battle of Bull Run. At his own request he was transferred to the department of the Northeast, and in 1865 to Missouri. After the war he served in the department of the Pacific and resigned in 1886, having been made major general in 1882. The failure of Pope's campaign resulting in his defeat at Bull Run was charged to the disobedience of Fitz-John Porter, who was court-martialed and dismissed from the army in 1863, but was restored in 1886. He wrote "Explorations from the Red River to the Rio Grande" and "The Campaign of Virginia."

Poplar (*pō'p'lər*), a genus of deciduous trees, widely distributed in the North Temperate Zone, particularly in the temperate parts of North America and Europe. About 20 species have been described, fully half of them being native to North America. Most of the species are of rapid growth, producing timber that is light and easily worked, but not particularly valuable for durable qualities. However, the wood is used extensively for fuel, while the trees are among the most highly prized for ornamental and shade purposes. The leaves are alternate and have a more or less tremulous motion, and the flowers include both barren and fertile, growing in catkins. Among the most noted



POPOCATEPETL

species are the aspens, cottonwood, and Lombardy poplar, these three being particularly peculiar for the tremulous motion of their leaves which is due in part to the length and slenderness of the leafstalk, but mainly to its being flattened vertically. Other well-known species include the Italian poplar, white poplar, balsam poplar, and Ontario poplar.

Poplar Bluff (*blŭf*), a city in southeastern Missouri, seat of Butler County, on the Black River, 160 m. s. of St. Louis. It is on the Missouri Pacific R.R. and Frisco Lines (freight). Manufactures include shoes, wearing apparel, and paper products. Poplar Bluff was incorporated as a city in 1892. Population, 1960, 15,926.

Poplin (*pōp'lin*), a fabric of French origin, first made at Avignon in the 15th century. It is a soft and elastic fabric, made by weaving a warp of silk with a weft of worsted yarn.

Popocatepetl (*pō-pō-kā-tā'pēt'l*), an active volcano of Mexico, situated 45 m. s.e. of the City of Mexico, in the state of Puebla. It has an elevation of 17,887 ft. The lower slopes are wooded, but the peak is covered with perpetual snow. The crater is about 250 ft. deep, measures ½ m. in circumference, and smoke issues from it at intervals; but no eruptions have occurred since the 17th century. It is the third-highest peak in North America.

Popovich (*pō-pōv'ich*), PAVEL ROMANOVICH, astronaut, born in Uzin, Ukraine, U.S.S.R., Oct. 5, 1930. The son of a sugar refinery worker, he joined Komsomol, the Communist Youth organization, in 1945 and the party in 1957. He entered the army in 1951 but later was transferred to an aviation school, where he qualified as a fighter pilot and rose to the rank of lieutenant colonel. The first man to join the Russian astronaut-training group, he became the fourth of

them to make a space flight. On Aug. 12, 1962, he was launched into orbit some 24 hr. after the launching of Maj. Andrian G. Nikolayev (*q.v.*). He landed in Kazakhstan on Aug. 15 after completing 48 orbits, during which he had been in both radio and visual contact with Nikolayev's ship. He was aloft 71 hr., 3 min. at a maximum altitude of 146 m., and traveled ca. 1,242,500 m.

Poppy (*pö'p'é*), a family (Papaveraceae) of herbs, including ca. 25 genera and 200 species, found mostly in the north temperate zone. The genus *Papaver* includes many of the best-known garden plants—which may be annuals, biennials, or perennials. The cultivated poppies (particularly varieties of *Papaver Rhoeas*, the corn poppy) have flowers—ranging in color from white, yellow, and blue to many shades of red and orange—with 4 to 6 large petals surrounding a central clump of stamens. The flower grows usually at the head of a single stem; the stem is often hairy, the leaves lobed or dissected. The plant yields a milky juice. In the opium poppy (*Papaver somniferum*), native to Greece and the orient, the seed capsule yields a juice from which is derived the drug opium.

Popular Front (*pö'p-ü-lär frönt*), also known as PEOPLE'S FRONT, name of a movement toward political collaboration of Communists, Socialists, and democratic parties against Fascism. The Popular Front was first suggested by the Communist (Third) International in 1935. Popular Front governments were temporarily in power in Spain and in France. In Spain, the united Fascist front defeated the Popular Front government in a protracted civil war (1936-39); in France, the Popular Front collapsed before World War II.

Population (*pö'p-ü-lä'shün*), a group of living organisms of a given type, occupying a definite territory, and participating to some extent in a group life. Emphasis is placed, primarily, upon the number of individuals involved. The term may be used in connection with any sort of creature, plant or animal, but it is usually understood to apply to a human group.

Even in considering human populations, the analogy with lower organisms is useful, because a human population is primarily a group of animals striving to eke out its existence in a physical setting, and the basic conditions and principles that underlie human growth are essentially similar to those that condition the increase of any other type of organism. These may be considered under two main heads: first, the intrinsic capacity of the particular type of animal to increase, and, second, the limitations which are actually placed upon its multiplication. As for the first consideration, there is not a species of plant or animal in existence that is not capable of overcrowding the entire globe in

a very few generations if there were nothing to stop it. This is a finite globe, however, and there is only a limited amount of food and living space available for each particular type of organism.

The result in nature is that every old species attains a maximum number and, after this is reached, has to submit to the law of stationary population over the long stretch of time, barring some changes in its environmental situation.

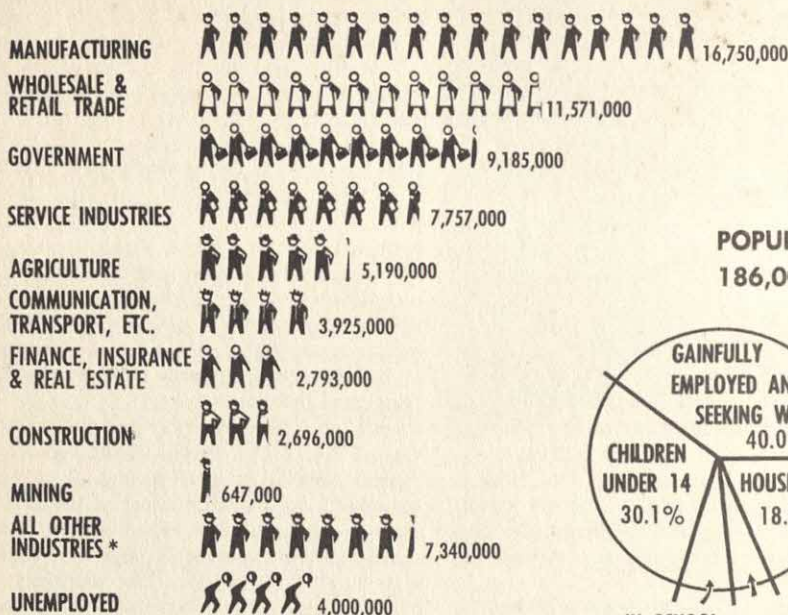
Thomas R. Malthus, an English clergyman, who first reduced these principles to a systematic basis for human beings, realized the situation clearly. He expressed it in the famous comparison that human populations tend to multiply at a geometrical ratio, whereas food cannot be increased at more than an arithmetical ratio. The natural tendency of the human species to grow is therefore restrained by unavoidable checks, of which Malthus discerned two main types. The first of these, which he called the *positive* checks, operate through deaths. Superfluous individuals are eliminated by war, pestilence, famine, and vice. The other set, the *preventive* checks, operate through the birth rate and, in Malthus' analysis, take the main forms of celibacy, deferred marriage, and also vice. Malthus made no allowance in his system for methods of voluntary control of births within the marriage bond which have become familiar and widespread today.

It is possible to look back over the career of man and visualize this basic procedure at work. Starting with a few hundreds or thousands of very primitive creatures, perhaps somewhere on the high central plateau of Asia, the species increased at an almost infinitesimal pace until the dawn of the modern era. The positive checks were operative all the time. A gradual increase in world population was made possible by a progressive movement over the earth's surface and by the slow development of arts of life which made it possible for men to derive more and more subsistence from the earth as the ages rolled by. About 200 years ago the combination of the opening up of the Western Hemisphere with spectacular discoveries in the way of technology and efficient production, usually called the industrial and agricultural revolutions, suddenly expanded the possibilities of human life, with the result that total world population, which in the year 1800 was somewhere around 900,000,000, has suddenly increased to well over 2,900,000,000 in present times. The actual numerical increase in the past century and a half has been much more than in the total previous span of human existence. This obviously raises vital questions as to how long mankind can continue to multiply as it has in the last few generations.

Living organisms have never been factually

WHAT AMERICANS DID IN 1962

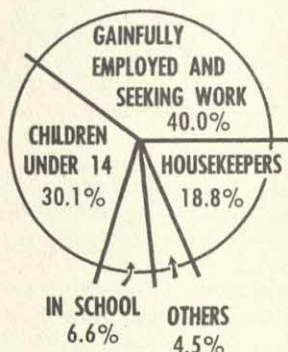
LABOR FORCE, 71,854,000 (incl. unemployed)



*including self-employed

Chart by GRAPHICS INSTITUTE, N. Y.

**TOTAL
POPULATION**
186,000,000



limited by their birth rates, but always by the environing conditions of existence. Human intelligence and modern science provide the possibility of altering this situation by bringing reproduction under rational control.

Naturally, the most spectacular instances of increase took place in those countries where the new scientific resources were applied to vast stretches of rich and unexploited land. The U.S. is an outstanding example. At the time it took its first national census in 1790 the total population was roughly 4,000,000. In 1960 it was over 179,000,000. The rate of increase had remained almost constant in the preceding decade, and yet the aggregate increase in the period from 1950 to 1960 was some seven times the total population of the country at its birth. See also *Census; United States*.

Today most Western countries have slowed their rates of growth and seem to be approaching a stationary population. On the other hand, Asiatic populations are still growing enormously. The increase of India's population in 1941-51 was over 42,000,000, a gain more than three times greater than the loss of life in World War II.

The civilized nations of modern times secure an approximately accurate estimate of their respective populations by taking a census at regular intervals. It is usual to obtain more information than the bare fact of the number of persons in the

nation. Such additional information is obtained as will supply a reasonably accurate knowledge of the age and vitality of individuals, their sex, and the relative conditions of the various industries, thus affording reliable intelligence as to the conditions under which the inhabitants may pursue their political life and thought.

As a result of the spread of census-taking, beginning with 1950, world and continental population estimates were, on the whole, more accurate than those made at previous times. The U.N. compiled the following estimates in 1957:

CONTINENTAL DIVISION	ESTIMATE
Africa	244,000,000
America, North	265,000,000
America, South	140,000,000
Asia (excl. U.S.S.R.) ¹	1,665,000,000
Europe (excl. U.S.S.R.) ¹	427,000,000
Oceania	16,400,000
U.S.S.R.	214,400,000
<i>World Total</i>	<i>2,971,800,000</i>

¹ European Turkey is included with Asia.

Among the continents, Europe is most densely populated, averaging 85 persons per sq. km., against, for example, 60 for Asia (without the U.S.S.R.) and 2 for Oceania. While the U.S. averages only 19 persons per sq. km., and Australia only 1, The Netherlands has 350 and Japan 251 persons per sq. km.

POPULATION

Natural Increase Rates: Selected Countries
(Rates are the excess of births over deaths per 1,000 population. Minus sign (—) denotes the excess of deaths over births.)

Country	1960	Average 1955-59	Average 1945-49	Average 1935-39
Australia ¹	13.8	13.8	13.2	7.6
Austria.....	5.0	4.4	1.4	0.8
Belgium.....	3.9	5.1	3.9	2.3
Canada.....	19.1	19.8	17.6	10.5
Ceylon.....	...	26.7	22.2	11.1
Chile.....	24.2	22.0	18.5	13.3
Denmark ²	7.0	7.7	12.0	7.2
Finland.....	9.6	10.8	15.2	5.9
France.....	6.5	6.6	6.4	—0.6
Germany, West.....	6.3	5.8	5.6 ³	7.5 ⁴
Ireland.....	9.9	9.1	8.8	5.1
Israel ⁵	21.2	21.7	21.8 ⁶	...
Italy.....	8.8	8.5	9.9	9.3 ⁷
Japan.....	9.6	10.4	13.3	11.8
Mexico.....	33.8	33.9	26.6	20.2
Netherlands.....	13.2	13.6	16.5	11.6
New Zealand.....	17.7	17.2	16.7	9.2
Norway.....	8.5	9.3	11.5	4.8
Portugal.....	13.0	12.4	11.6	11.2
Spain.....	13.2	12.0	10.2	4.1
Sweden.....	3.7	4.9	8.6	2.8
Switzerland.....	7.9	7.6	8.3	3.8
United Kingdom.....	6.0	4.8	6.7	3.1
United States.....	15.1	15.2	13.4	6.2 ⁸
Venezuela.....	41.6	37.4	25.1	14.8

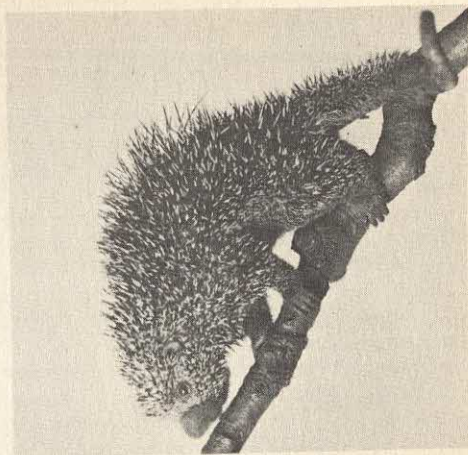
¹ Excluding full-blooded aborigines. ² Excluding Faeroe Islands and Greenland. ³ For 1946-49. ⁴ For Germany, territory of 1937. ⁵ Except for 1957-59, excluding Bedouin population in the Negev. ⁶ For 1949 only. ⁷ For territory of 1924-38. ⁸ Excludes data for Alaska.

Population, CENTER OF, the locality constituting the center of population of a state or nation. The center of population of the U.S. has moved westward continuously since the first census was taken, in 1790, when it was 23 m. E. of Baltimore, Md. It was 18 m. W. of Baltimore, Md., in 1800; 40 m. N.W. by W. of Washington, D.C., in 1810; 16 m. E. of Moorefield, W. Va., in 1820; 19 m. W.S.W. of Moorefield, W. Va., in 1830; 16 m. S. of Clarksburg, W. Va., in 1840; 23 m. S.E. of Parkersburg, W. Va., in 1850; 20 m. S. by E. of Chillicothe, Ohio, in 1860; 48 m. E. by N. of Cincinnati, Ohio, in 1870; 8 m. W. by S. of Cincinnati, Ohio (in Kentucky), in 1880; 20 m. E. of Columbus, Ind., in 1890; 6 m. S.E. of Columbus, Ind., in 1900; in the city of Bloomington, Ind., in 1910; 8 m. S.S.E. of Spencer, Ind., in 1920; 3 m. N.E. of Linton, Ind., in 1930; 2 m. S.E. by E. of Carlisle, Ind., in 1940; 8 m. N.N.W. of Olney, Ill., in 1950 before the addition of Alaska and Hawaii; and 6½ m. N.W. of Centralia, Ill., in 1960. Of the 1950-60 shift of 57 m., 18 m. was due to the addition of Alaska and Hawaii. The total westward movement from 1790 to 1960 was 701 m. The greatest single shift, 80.6 m., occurred from 1850 to 1860.

Populist (pōp'ū-list). See *People's Party*.

Porcelain (pōr'sē-lin). See *China-ware*.

Porcupine (pōr'kū-pin), a rodent quadruped suborder, the *Histricomorpha*. All porcupines have coarse hair thickly interspersed with erectile quill-like spines, especially on the rump and tail, used as a means of defense. There are a large number of species, varying greatly in size and



Courtesy N. Y. Zoological Society

BRAZILIAN TREE PORCUPINE

habits. The *Canada porcupine* is native to the temperate parts of North America. The animal is about 2 ft. long and weighs from 20 to 30 lb. It has short quills concealed in the fur, small ears, and a comparatively short tail. The genus *Coendus* is common to the warmer parts of America and is remarkable for its prehensile tail, which it uses as an aid in crawling among the branches of trees. Among the species is the *Brazilian tree porcupine*. The *crested porcupine* is widely distributed in Eurasia and Africa. This species has a grizzled-black color and is ca. one-third larger than the North American porcupine. The spines lie flat and concealed until the animal becomes excited, when they assume an erect position. The quills of the North American species are considerably smaller than the rapierlike ones of the crested porcupine; the smaller quills are, however, very effective barbed darts. The porcupine backs into the face of an aggressor and drives its quills into the enemy's flesh with its tail. Most species of porcupines are torpid in winter and generally solitary in habits. They live mostly on fruit, roots, and other vegetable substances, for which they search at night, lying concealed in their burrows during the day.

Porgy (pōr'gē), a family (Sparidae) of the Percoidei order of fishes, including some 100 species. Most common in the warmer waters along the eastern coast of North America, in the West Indies and the Mediterranean and Red seas, the family includes some important food fish. Notable among these is the northern scup (*Stenotomus chrysops*), a bottom feeder, carnivorous, and ca. 1 lb. in weight. Found along the Atlantic coast, it is sold in the market under the name scuppaug. The sheepshead (*Archosargus probatocephalus*), once common around New York and in Chesapeake Bay, has become rare in these areas but is found southward from North Carolina. Omnivorous, about 6 lb. in weight, it appears

to be "buck-toothed" and has seven dark vertical bands on its body.

Porgy and Bess (*pôr'gĭ and bĕs*), opera by the American composer George Gershwin (*q.v.*), based on the novel "Porgy" by Dubose Heyward (*q.v.*).

Pork (*pôrĕ*), the flesh of swine, either fresh or salted. It is used as food. The pork obtained from young and properly fed animals is easily digested, and, when occasionally eaten, is highly wholesome. The heat-giving qualities of pork make it of special value in temperate and cold climates, while its property of being capable of preservation by smoking, salting, and drying renders it one of the most valuable meats in the market. No other animal food may be so easily preserved by means other than refrigeration, and it is, therefore prepared in vast quantities as food for home use and for armies and navies. The Mosaic law forbade the use of swine as food, and the Jews still regard the animal as unclean. Similar views are held by certain other peoples. However, most people now regard pork as one of the most wholesome foods. Products derived from it enter to a large extent into the foods of mankind.

Pornography (*pôr-nôg'ra-fĭ*), originally the portrayal or description of prostitutes or prostitution, hence obscene, indecent, or licentious writing, painting, etc. Both common and statute law in most countries forbid the publication of such matter. The mailing of pornographic literature has been rendered illegal by act of Congress. The motion-picture industry has adopted its own code which is designed to prevent the filming of pornographic scenes.

Porosity (*pôr-rôs'i-tĭ*), the quality or property of possessing pores, on account of which no kind of matter, whether solid or liquid, completely fills the space it occupies. Sponges, bread, and many kinds of wood are very porous. However, the pores of some bodies are as completely invisible to the eye as the smallest atom. Pores are caused by the fact that the molecules of which a body is composed are not in actual contact, but are separated by minute spaces. This may be illustrated by adding a quantity of fine salt to a bowl full of water, which may be done without the liquid running over, but care must be exercised in giving the salt time to dissolve and the bubbles of air to pass off. Water may be forced under heavy pressure through metals, such as silver, iron, and steel. A test of this kind is applied to heavy cannon, the water being forced into the gun by hydrostatic pressure until it oozes through the thick metal and covers the outside of the gun like froth, and, after gathering in drops, it runs to the ground in small streams. Porosity enters as a property of vast importance into natural phenomena, since water

sinking into the earth, sap rising in vegetables, and other essential actions in nature are partly due to it.

Porphyry (*pôr'fĭ-rĭ*), the name applied originally to a rock having a purple-colored base, with inclosed individual crystals of a feldspar. The term now applies to any fine-grained rock containing distinct crystals of any mineral or minerals, and possessing the property of taking a fine polish. Thus, any rock in which crystals of quartz and other crystalline minerals are developed individually in a ground mass of relatively fine-grained matrix rock, irrespective of the mineralogical composition of the whole, is said to be *porphyritic*. Rocks of this character have been used for sculptures from remote antiquity, the ancients deriving their supply from an extensive deposit in Egypt, between the Red Sea and Siout, and from several regions of Western Asia. Valuable deposits are abundant in Germany and Great Britain. A familiar variety of porphyry has a pale red color with traces of green, white, and black.

Porpoise (*pôr'pŭs*), a rather broad term applicable in general to almost any one of the many small cetaceans. Though fishlike in form and with its external surface hairless, the porpoise is a true warm-blooded mammal that suckles its young on milk and would drown if it did not come up frequently to breathe air. In a stricter sense, the term porpoise refers only to the few rather small, round-headed forms that do not have the snout extended into a beak, a characteristic used to distinguish the porpoise from the dolphin.

Dolphins are porpoiselike in every respect except that the muzzle is elongated into a beak. The line of demarcation between the two kinds, however, is provisional rather than exact. Of the many forms to which the name dolphin is applied there is a variable degree of graduation in the form of a beak—from a mere ridge to a long, slender prolongation a foot or more in length.

Typical porpoises travel in schools and follow the coast lines rather than the open sea although they may ascend rivers in pursuit of fish. Dolphins of some species are oceanic, others frequent coastal waters, and a few live exclusively in fresh water. They are mostly sociable and travel in schools though a few, except for family groups, are more or less solitary. Herring, mackerel, and salmon are among their principal sources of food in season, but some eat squid and cuttlefish. Oil derived from the blubber of the porpoise is used as a lubricant for fine and delicate mechanical instruments. See *Whales*.

Portage (*pôr'tij*), county seat of Columbia County, Wisconsin, 35 m. n. of Madison. It is on the Wisconsin River, at the terminus of the



JAPANESE WOODCUT OF THE BATTLE AT PORT ARTHUR, MANCHURIA, 1904-05

Fox River Ship Canal, and on the Soo Line and other railroads. The surrounding country is fertile. The manufactures include hosiery, shoes, brick, flour, and farm machinery. Portage was settled in 1793. Population, 1950, 7,334.

Portage La Prairie (*pōr'tij lā prā'ī*), capital of Portage La Prairie County, Manitoba, on the Assiniboine River and on the Canadian National, the Canadian Pacific, and other railroads. It is in a fertile farming country and has creameries, brick yards, machine shops, electric and gas plants, and railroad works. The chief buildings include the courthouse, city hall, a home for incurables, an industrial school, and many churches. It was settled about 1820 and incorporated in 1885. Population, ca. 7,000.

Portal (*pōr'tal*), SIR CHARLES FREDERICK ALGERNON, British air force officer, born in Hungerford, Berkshire, England, in 1893. He served in World War I from 1914-18, and rose to prominence for his organizational skill during World War II. In 1937-38, he directed the organization of the air ministry, and two years later commanded the British flying squadrons which turned back the Luftwaffe over England. He was promoted to air chief marshal (1940) and placed in staff command of the Royal Air Force. He was created a knight Grand Cross of the Bath in 1942.

Port Arthur (*pōrt ā'thūr*), a seaport in Jefferson County, Texas. It is an oil refining and chemical center, located on the west shore of Sabine Lake. The lake, at the mouth of

the Sabine River, the boundary between Texas and Louisiana, empties into the Gulf of Mexico. The Kansas City Southern and the Southern Pacific R.R.'s serve the city. The Intracoastal Canal, of barge depth, joins the Sabine-Neches ship canal at the city. In the immediate vicinity are extensive oil fields and both oil and natural gas refineries, synthetic rubber plants, nylon plants, salt plants, and such industries as steel-processing plants and shipyards. The primary agricultural products are rice and beef cattle, and shipping interests are primarily petroleum and petroleum products, lumber, grain, and livestock. It is the nation's seventh port in respect to tonnage (more than 21,000,000 short tons annually). The city was founded in 1895 and incorporated in 1898. Population, 1920, 22,251; in 1950, 57,530.

Port Arthur, a city and lake port in the Province of Ontario, Canada, in Thunder Bay County, on Thunder Bay, an inlet of Lake Superior. It is served by the Canadian National and Canadian Pacific Rys. and is an important transshipment point. The city has many large grain elevators and one of the largest shipyards in Canada. Its other industries include the manufacture of pulp and paper, lumber and furniture, iron products, and machinery. In the vicinity are extensive marble quarries, sawmills, and gold and iron mines. The city is also the center of a popular tourist region. Its twin city, Ft. William (*q.v.*), is to the south. Port Arthur was founded in 1866 and was incorporated

as a city in 1907. Population, in 1956, 37,592.

Port Arthur, or LÜSHUN, or LÜSHUNKOW, a seaport in southern Manchuria, on the Liaotung Peninsula, ca. 275 m. s.e. of Peking, China. It is the terminus of the South Manchuria Ry. Port Arthur was first visited by the British in 1860. As the principal Chinese naval base, it was taken by Japan in 1894 but was soon returned to China. Included in the lease of territory to Russia in 1898, it was held by Russia until captured (1905) by Japan during the Russo-Japanese War. In World War II Port Arthur was taken (1945) by Russian troops; by the terms of the Crimea Conference (q.v.) it was made a joint Chinese-Russian naval base. In 1949 it was combined with Dairen to form the city of Port Arthur-Dairen. In 1955 it was returned to China. Population (combined city), 1950, 1,054,000.

Port-au-Prince (pôr-tô-prāns'), capital of the republic of Haiti, situated in the western part of the island of Haiti, on a bay of the same name. It has a beautiful site, but has declined in importance since French occupation of the island ceased. The principal buildings are several government structures, a hospital, the mint, a lyceum, and the custom house. It has a number of churches, and several elementary schools. The city has a considerable trade in coffee, mahogany and redwood, coconuts, and fruits. Population, ca. 100,000.

Port Chester (pôrt chēs'tēr), a village in Westchester County, New York, 25 m. n.e. of New York City, on the New York, New Haven & Hartford R.R., and on Long Island Sound. It is a popular residential suburb of New York City. The manufactures include woolen goods, clothing, hardware, candy, and underwear. Port Chester was settled about 1742 and was known as Saw Pit until 1837. It became an incorporated village in 1868. Population, in 1950, 23,970.

Portcullis (pôrt-kûl'lis), a framework of strong bars of wood or iron. It is usually adjusted to slide vertically in grooves on either side of the portal of a fortified place, and is so constructed that it may be quickly dropped to close the entrance in case of surprise. The lower ends were formerly supplied with sharp-pointed bars, which were intended to strike anyone attempting to enter. In the Middle Ages it was common to have one or more portcullises at the entrance of castles and retreats built to insure safety, and in some countries of Europe and Asia they are still in use. The weight of many is so heavy that it is necessary to provide a powerful windlass to raise them.

Port Elizabeth (pôrt ê-liz'â-bêth), a seaport of South Africa, in Cape of Good Hope Province, on the western shore of Algoa Bay. Among the most noteworthy structures are the Roman Catholic cathedral, the Gray Inst. Schools, the high

school, several colleges and hospitals, and a number of fine churches. It has a large trade in wool, feathers, skins, machinery, and utensils. Railroad and steamboat lines provide transportation. Population, ca. 58,000.

Porter (pôr'tēr), COLE, composer and lyricist, born in Peru, Ind., June 9, 1893. He was graduated from Yale Univ. in 1913. Although he originally intended to become a lawyer, his interest in music caused him to transfer from the Harvard Law School to the Harvard Music School in 1915; thereafter he devoted himself to music with the exception of the years during World War I, when he served with the French forces. He has composed music and written lyrics for a long list of musical comedies. Among the shows which have featured his sophisticated compositions are "See America First" (1916), "Greenwich Follies" (1923), "Panama Hattie" (1940), "Let's Face It" (1941), "Something for the Boys" (1942), "Mexican Hayride" (1943), "Seven Lively Arts" (1944), "Kiss Me, Kate" (1948), "Silk Stockings" (1954), and the motion pictures "Night and Day" (1946), a film based on his life, and "High Society" (1956). One of his most familiar songs is "Begin the Beguine."

Porter, DAVID, naval officer, born in Boston, Mass., Feb. 1, 1780; died in Constantinople, Turkey, Mar. 3, 1843. He entered the navy as midshipman in 1798, became lieutenant the following year, and took part in the Tripolitan War. He was captured with the *Philadelphia*, in 1803, and remained a prisoner until the war closed. In 1812 he was appointed captain and with the *Essex* captured a number of British prizes and the man-of-war *Alert*. He started on a cruise in the Pacific with the *Essex* in 1813, where he destroyed nearly the entire British whale fisheries and took possession of the Marquesas Islands. On Mar. 28, 1814, the *Essex* fought a desperate battle with the *Phoebe* and *Cherub* in the harbor of Valparaiso, in which the *Essex* was completely disabled and surrendered, and Porter returned home on parole. He was naval commissioner from 1815-23. The following year he fought against the West India pirates, and in 1825 was court-martialed and temporarily suspended from duty for requiring Puerto Rican officers to apologize for detaining some of his men. In 1826 he resigned his commission to take charge of the navy of Mexico, but in 1829 returned to the U.S. and was appointed consul to Algeria. He became minister to Turkey in 1831, a position he held until his death. He published "Journal of the Cruise of the *Essex*" and "Constantinople and Its Environs."

Porter, DAVID DIXON, admiral, born in Chester, Pa., June 8, 1813; died in Washington, D.C.,

Feb. 13, 1891. He was a son of David Porter (*q.v.*), entered the navy in 1829 as midshipman, and was employed on the coast survey from 1836 to 1841. In the latter year he became lieutenant and served at stations in the Mediterranean and Brazil until 1845, when he returned to the coast survey. He became commander of the *Powhatan* at the beginning of the Civil War, was employed for a time at Pensacola, and in 1862 bombarded Fts. Jackson and St. Philip, aiding Farragut in the enterprise of taking New Orleans. In the same year he successfully passed the batteries of Vicksburg, where he operated actively in the siege and the following year captured Arkansas Post. He was promoted to rear admiral in 1863, took Grand Gulf, near Vicksburg, and co-operated with Grant in the reduction of that stronghold. In the following year he aided Banks in the Red River expedition and was transferred to the North Atlantic squadron in December of the same year, when he made two powerful assaults on Ft. Fisher, which he finally captured in January 1865, with the aid of the military forces. He was promoted to the rank of vice admiral in 1866 and was made admiral in 1870. Until 1869 he was superintendent of the Naval Acad. at Annapolis, but in 1870 succeeded Farragut as admiral of the navy. He wrote "History of the Navy in the War of the Rebellion" and "Incidents and Anecdotes of the Civil War."

Porter, FITZ-JOHN, soldier, born in Portsmouth, N.H., June 13, 1822; died May 21, 1901. Commodore David Porter was his uncle. He was graduated from the West Point Military Acad. in 1845 and immediately entered the Mexican War, serving throughout the contest. Besides taking part in the siege of Vera Cruz and the battles of Cerro Gordo and Chapultepec, he aided in the assault upon the City of Mexico. He was wounded in the latter and soon after was made an instructor at West Point. At the beginning of the Civil War he became colonel, and then brigadier general, and was assigned by Gen. McClellan to a command in the Army of the Potomac. After taking part in the Peninsular campaign, in 1862, he superintended the siege of Yorktown, and was attached to Gen. Pope's army of Virginia in his campaign against Lee and Jackson.

Porter and his corps were present at the Second Battle of Bull Run, Aug. 29-30, 1862, and in the afternoon of the first day of the battle he was ordered to attack Jackson, but this he disregarded. His conduct became the subject of a long controversy and Pope charged him with being the cause of the defeat of the Union army. His defense was that the order of attack came so late in the afternoon that he thought it advisable not to make an assault, since he con-

sidered an overwhelming defeat to be inevitable on account of superior opposing forces, thus exercising only the discretion commonly vested in subordinate commanders. However, he was court-martialed and deprived of his command. For more than 20 years the justice of this sentence was a subject of general discussion. He was restored to the rank of colonel in 1886 and placed on the retired list at his own request. From 1884-88 he served as police commissioner in New York.

Porter, GENE STRATTON, author, born in Wabash County, Indiana, in 1868; died in 1924. Her books about nature and for young people earned her a prominent place among American fiction writers. Best known of her works are "Freckles" (1904), "A Girl of the Limberlost" (1909), "Laddie" (1913), "Friends in Feathers" (1917), and "The Keeper of the Bees," published posthumously in 1925.

Porter, HORACE, soldier and diplomat, born in Huntingdon, Pa., Apr. 15, 1837; died in New York City, May 28, 1921. After studying a year at the Lawrence Scientific School, Harvard, he entered West Point Military Acad. and was graduated from the latter in 1860. He was chief of ordnance and artillery in the siege of Ft. Pulaski, Georgia, in 1862, was transferred to the Army of the Potomac, and after the Battle of Antietam was ordnance officer on the staff of Gen. Rosecrans. In 1864 he was made aide to Gen. Grant and took part in all the battles around Richmond until the surrender at Appomattox Courthouse. Subsequently he was made brigadier general in the regular army, serving as private secretary during the first administration of President Grant, and 1873 became president of the West Shore R.R. President McKinley appointed him ambassador to France in 1897. He published "West Point Life."

Porter, JANE, novelist, born in Durham, England, in 1776; died in Bristol, May 24, 1850. She was a sister of Sir Robert Ker Porter, studied in Edinburgh and London, and in 1803 published the long-popular romance, "Thaddeus of Warsaw." "Scottish Chiefs" followed seven years later. This work was an interesting historical novel, but the theme was treated more extensively by Sir Walter Scott. Other works from her pen include "Tales Round a Winter's Hearth," "Pastor's Fireside," and "Field of Forty Footsteps."

Porter, NOAH, educator and author, born of Puritan ancestry in Farmington, Conn., Dec. 14, 1811; died at New Haven, Mar. 4, 1892. He was graduated from Yale Coll. in 1831 and engaged in teaching school. From 1831 to 1833, he taught in the Hopkins Grammar School at New Haven, later becoming a tutor and student of theology at Yale from 1833 to 1835. He was elected pro-

fessor of moral philosophy and metaphysics in 1846. As president of Yale in 1871, he introduced a new elective system in the curriculum and believed in the primary importance of the classics. He resigned the presidency in 1886, but continued to hold his professorship until his death.

Ranking among the foremost American metaphysicians of his time, he contributed several important works in this field. His published works include: "Human Intellect" (1868); "Books and Reading" (1870); "Science of Nature Versus the Science of Man" (1871), a review of the philosophy of Spencer; "American Colleges and the American Public" (1871), and "Elements of Moral Science" (1885). He edited the revised editions of "Webster's Dictionary" of 1864, 1880, and 1890.

Porter, WILLIAM SYDNEY. See *Henry, O.*

Portes Gil (*pôr'tās hē'l*) EMILIO, see *Gil, Emilio Portes*.

Port Hope (*pōrt hōpe*), a town of Durham County, Ontario, on Lake Ontario and on the Canadian Pacific and the Canadian National R.R.'s, 63 m. E. of Toronto. The features include the courthouse and Trinity Coll. It has canning works, machine shops, and gas and electric plants. The place was settled in 1798. Population, ca. 4,500.

Port Hudson (*pōrt hūd'sūn*), SIEGE OF, an attempt to capture Port Hudson, a village in Louisiana, in the American Civil War. It is situated on the Mississippi, 135 m. above New Orleans, and was strongly fortified by the Confederates to control navigation on the Mississippi. Gen. Gardner commanded the garrison with about 7,500 men, while the Federal force under Gen. Banks and Adm. Farragut numbered fully 20,000. The place was invested by the Federals on Mar. 26, 1863, but it withstood numerous attacks until July 9, after Gen. Grant had taken Vicksburg.

Port Huron (*pōrt hū'rūn*), a port of entry and county seat of St. Clair County, Michigan, at the lower end of Lake Huron, on the St. Clair River, 60 m. N.E. of Detroit. It is on the Grand Trunk, Port Huron-Detroit, and Père Marquette R.R.'s, and has steamboat connections with the principal ports of the Great Lakes. It is the chief commercial center of a predominantly agricultural region. The city has a number of grain elevators and extensive railroad shops. The outstanding buildings include the county courthouse, the Carnegie public library, the city hall, the public hospital, the junior college, the museum, and many fine churches. Among the important manufactures are brass, paint, paper, marble products, engines, ironware, machinery, and earthenware. It is connected by ferry, a railway tunnel, and the Blue Water International Bridge with Sarnia, in Canada, and is a center for trade in lumber, produce, and merchandise. Port Huron was set-

tled by the French in 1790, incorporated as a village in 1849, and made a city in 1857. Population, 1940, 32,759; in 1950, 35,725.

Portia (*pōr'shī-ā*), character in Shakespeare's "Merchant of Venice." Pleading before the Venetian court for her husband's friend, Antonio, she makes the famous "quality of mercy" speech against Shylock's demand for a "pound of flesh."

Portinari (*pōr-tē-nā'rē*), CANDIDO, Brazilian painter, born 1903, at Brodowski, state of São Paulo, Brazil. In early youth he showed artistic interest and talent, and therefore his parents, Italian immigrants, although rather poor, made it possible for him to enter the National School of Fine Arts (1918). After 10 years of study there, a traveling scholarship enabled him to go to Paris. When he returned to Brazil, he soon managed to become a fashionable portrait painter. In 1936 he was appointed professor of painting at the Univ. of the Federal District. Portinari frequently takes the models for his paintings from the colored population of his own country—Negroes and Indians—depicting them in a lively fashion in bright, clear colors. His figures are usually rather massive, sometimes reminiscent in concept and draftsmanship of Italian Renaissance works, perhaps significant of a feeling inherited from his Italian father. A series of murals, showing various occupations in Brazil, decorating the walls of the Building of Education and Health in Rio de Janeiro, are among his best known works. Portinari is considered the representative artist of Brazil today. He was introduced to the public of the U.S. in three exhibitions during 1940.

Port Jervis (*pōrt jēr'vīs*), a village of Orange County, New York, on the Delaware River, 60 m. N.W. of New York City, on the Erie and the New York, Ontario & Western R.R.'s. "Tri-State Rock," which marks the junction point of New York State, New Jersey, and Pennsylvania, is located here. Port Jervis was laid out in 1826 and incorporated as a village in 1853, as a city in 1907. Population, in 1950, 9,372.

Portland (*pōrt'land*), county seat of Jay County, Indiana, 49 m. S.W. of Ft. Wayne, on the Salamanie River and served by the Nickel Plate and Pennsylvania R.R.'s. It has a courthouse and Federal building. The industries include meat packing, machine shops, and tile works. The place was settled in 1836. Population, 1950, 7,064.

Portland, largest city in Maine and seat of Cumberland County, 110 m. N.E. of Boston. It is located on Casco Bay, an inlet from the Atlantic, and is served by the Grand Trunk, the Boston & Maine, and the Maine Central R.R.'s. The harbor of Portland, a port of entry, is sufficiently deep to serve ocean-going vessels. It is the only northern port in the North Atlantic that is ice free through-

PORTLAND



Courtesy Ewing Galloway

FIRST PARISH CHURCH, PORTLAND, MAINE

out the year. The city's area is 21.57 sq. m. Within the bay are numerous wooded islands, a number of which are popular as summer resorts. Cushing's Island contains Ft. Levett; Great Diamond Island has Ft. McKinley; and Portland Head contains Ft. Williams.

The public parks embrace about 516 acres. They include Lincoln, Deering Oaks, Ft. Allen, and Ft. Sumner parks. Monument Sq. has a soldier's monument. Eastern Cemetery (1668), on the southern slope of Munjoy's Hill, contains the remains of a number of noted persons. Among the buildings of historical interest are the birthplace of Henry W. Longfellow, and his home (now a museum).

Portland is the commercial center for northern New England and the supply point of the Montreal pipeline carrying petroleum products to Montreal. The principal manufactures include ships, bakery products, cans, confectionery, printed and published materials, foundry products, machinery, elevators, furniture, clothing, paper boxes, shoes, and wooden products. It is also the center of the fishing industry in Maine.

The first settlement on the site of Portland was made in 1632, when it was known by the Indian name of Machegonne. Later the name was changed to Stogomer, then to Casco Neck, and still later to Falmouth. The Indians destroyed it in 1676, and after its rebuilding, again in 1690. The British burned it in 1775, but it was rebuilt during the Revolutionary War and incorporated as Portland in 1786. It was the state capital in 1820-32. The present city charter dates from 1832, and in 1950 Portland adopted the council-manager form of government. Population, 1900, 50,145; in 1950, 77,634.

Portland, largest city in Oregon and seat of Multnomah County, situated on the Willamette River, 10 m. s.e. of its confluence with the Columbia River, in the northwestern part of the state. It is served by the Union Pacific, the Great Northern, the Southern Pacific, the Northern Pacific, and the Spokane, Portland and Seattle R.R.'s. The Portland International Airport is located 8 m. n. of the center of the city.

DESCRIPTION: Among the city's important thoroughfares are Banfield Expressway (east from the Willamette River), Burnside St. (east and west), Harbor Drive (north and south). The commercial district, for the most part, is located on the west side of the river, in the southwestern section of the city. The Equitable, Oregonian, Public Service, and Journal buildings are among the city's outstanding structures.

Portland enjoys a mild climate and attracts many tourists. Its parks and gardens cover an area of 5,689 acres. Among its leading annual attractions are the one-week Rose Festival, held during the first part of June, the Pacific International Livestock Exposition, and the winter sports at Mt. Hood (*q.v.*).

COMMERCE: Portland is the center of an industrial, shipping, agricultural, and recreational area which includes the Columbia River, the Willamette Valley, and the Cascade Mts. The city's rivers maintain a 35-ft.-deep channel to the sea at mean low tide, and ships of 50 steamship lines use Portland's harbor facilities. The Portland standard metropolitan area, which includes Clark County in Washington State and Washington, Multnomah, and Clackamas counties in Oregon, had a value added by manufacture of \$475,021,000 in 1954; the figure for the city proper was \$273,458,000. The major industries are food processing and the production of textiles, lumber, paper, chemicals, and machinery.

AIR VIEW OF PORTLAND, OREGON

Courtesy Portland Chamber of Commerce



EDUCATION AND CULTURAL FACILITIES: The public schools enroll ca. 75,000 pupils annually; the parochial schools, ca. 12,000. Institutions of higher education include Portland State Coll., Reed Coll., the Univ. of Portland, Lewis and Clark Coll., and the medical and dental schools of the Univ. of Oregon. Among the city's cultural facilities are a symphony orchestra, the Oregon Historical Society, and the Portland Art Museum.

GOVERNMENT: Portland adopted a commission form of government in 1913. The mayor and four commissioners are elected for four-year terms.

HISTORY: Founded in 1845 and named for Portland, Maine, the city was incorporated in 1851. Disastrous fires swept the city in 1872 and 1873. In 1948 a Columbia River flood caused heavy damage, completely destroying the Vanport area, a World War II town on the northern outskirts of the city.

POPULATION: In 1860 Portland had a population of 2,874; by 1900 it was 90,426. The city's decade of greatest growth was between 1900 and 1910—during which period the population rose to 207,214. In 1940 it was 305,394, and in 1950, 373,628, an increase of 22.3 per cent. In 1960 the population was 372,676.

Portland Cement. See *Cement*.

Portland, ISLE OF, a rocky peninsula which comprises an urban district of Dorsetshire, England, in the English Channel. Formerly an island, it is connected with the mainland by a ridge of shingle called the Chesil Bank. The island is ca. 4 m. long and nearly 1 1/4 m. wide, and is formed largely of Portland stone, which is highly valued for building. In previous years the Isle of Portland was the site of a British prison, and the convicts worked the quarries. Since 1921 the prison quarters have been used as a Borstal institution, i.e., a training establishment for juvenile delinquents. The coast line is rough and precipitous, with its only useful anchorage (protected by a breakwater) being on the south side. The southern point of the peninsula is called the Bill of Portland, off which is a dangerous surf called the Race of Portland. In addition to the famous prison buildings, the Isle of Portland is notable for Portland Castle, built by Henry VIII in 1530. It is also the site of an ancient fortress believed to date from the time of William Rufus. Population, 1951, 11,324.

Portland Vase, a notable example of Roman art, discovered near Rome, in the 17th century. It is made of transparent dark-blue glass, is ca. 10 in. high, and is considered the finest specimen of cameo-cut glass extant. Placed in the Barberini Palace, Rome, it was purchased (1770) by Sir William Hamilton, who sold it to the duchess of Portland, for whom it was named. In 1810 it was placed on display in the British Museum. In



PORTLAND VASE

1845 it was broken but was skillfully repaired. One of the notable works of the potter Josiah Wedgwood was a copy of the Portland Vase, in blue-black jasper stoneware.

Port Louis (*pórt lóó'is*), the capital of the island of Mauritius, in the Indian Ocean, east of Madagascar. Port Louis is the principal seaport of the British colony of Mauritius. It is situated on the northwestern coast, on a gradually sloping elevation averaging about 2,000 ft. above sea level. The city is the chief commercial center of the colony and has a number of barracks, military stores, and hospitals. The botanical garden contains a fine collection of flowers and plants. It has a large trade in fruits, wool, clothing, and utensils. Population, 1957, 101,145.

Port Moresby (*pórt móra'bý*), a seaport on the southern coast of Papua, in the southeastern part of New Guinea (q.v.). Capital of the Australian Territory of Papua, it was named for Capt. John Moresby, who discovered its harbor in 1873. Port Moresby has communication with Australia by air and steamship. Its principal trade is with Queensland and New South Wales. During World War II, Japanese forces failed in attempts (December 1942-January 1943) to take Port Moresby by attack over the Owen Stanley Mts. The town subsequently became an important Allied base. Population, ca. 2,500.

Porto (*pórt'ó*) or *OPORTO*, a city and seaport of Portugal, next in size to Lisbon, capital of Porto district, on the Douro River, ca. 170 m.

PORTO ALEGRE

n. of Lisbon. The site is a fine tract of land along the river, rising by successive terraces toward the inland. It has communication by steamboats and steam and electric railways, and is the meeting place of three main railroads. Several fine bridges cross the river, connecting it with Villa Nova de Gaia, on the opposite side. The bridge Dom Luiz I, constructed 1881-85, has a span of 560 ft., one of the largest of Europe. The noteworthy buildings include the Gothic Church of San Francisco, the Clerigos Church, and the Crystal Palace. Much of the architecture of the city is Oriental in appearance.

The manufactures include wines and liquors, cotton and woolen goods, boots and shoes, sugar, cork, tobacco products, ribbons, soap, hats, porcelain, machinery, and sailing vessels. It has a large export trade in oranges, port wine, and cereals. Porto had a reputation as a commercial city in the time of the Moors, when it was largely in the hands of the Christians. It withstood many attacks during the Middle Ages, but was captured by the French in 1808. As the capital of Northern Portugal, Porto has frequently figured in the country's history. Population, ca. 350,000.

Porto Alegre (*pôr'tô a-lê-grâ*), a Brazilian seaport, capital of the extreme southern state of Rio Grande do Sul, situated on Lagoa dos Patos, founded in 1743. With broad streets, skyscrapers, two airports, and three long-wave broadcasting stations, Porto Alegre is rapidly becoming one of the most modern Brazilian cities. Shipbuilding, cotton fabrics, shoes, ironware, furniture, and dairy products are the chief industries. The climate is temperate. Population, ca. 325,000.

Port of Spain (*pôr't of spân*), a city near the western coast of the island of Trinidad. It is connected with the interior by a railway line. The harbor is sufficiently deep only for the smaller vessels, goods being landed from the larger ships by flatboats and from a pier. The trade is important, especially in tropical fruits, coffee, tobacco, lumber, and cereals. St. Mary's Coll., an affiliate of Queen's Royal Coll., is located here. Population, ca. 75,000.

Porto Rico (*pôr'tô rî-kô*). See *Puerto Rico*.

Port Radium (*pôr't râ-di-ûm*), Canadian mining town on the shores of Great Bear Lake. Chief product of the Eldorado Mine is pitchblende from which uranium, vital component of the atomic bomb, is obtained. The mine, under supervision of the Canadian government, is one of the chief sources upon which the vast program of the American-Anglo-Canadian atomic research program was based. Population, ca. 225.

Port Royal (*pôr't rû-âl*), an island in Beaufort County, South Carolina, 16 m. from the coast and 50 m. s.w. of Charleston. The island is flat and marshy for most of its 13 m. of length and 7 m. of width. Beaufort, with a 1960 popula-



Courtesy House of Portugal, N. Y.

CHIEF BUSINESS SECTION OF PORTO

tion of 3,185, is the county seat. A popular winter resort with an excellent harbor, Port Royal exports cotton, rice, and timber. The town of Port Royal is adjacent to the large U.S. Marine Training base at Parris Island, S.C. The town leads all other seacoast towns in South Carolina in seafood production, and especially in the production of jumbo shrimp. It is a popular center for the sport of winter fishing. It was settled in 1562 by French Huguenots, and in 1683 by Scots. The first permanent settlement was made in 1710. In 1779 British troops seized the island, and during the Civil War the Confederates were ousted in 1861.

Port Said (*pôr't sâ-id*), a seaport of Egypt, on the Mediterranean Sea, immediately west of the Suez Canal. The city is situated on a narrow strip of land that is separated from the Mediterranean by Lake Menzaleh. Its growth is limited because of an inadequate water supply and the barren nature of the land on which it is located. Port Said owes its existence to the Suez Canal. It was founded in 1859 and was so named from the patron of the enterprise, Said Pasha. It has a considerable canal and sea trade and is important as a coaling station. The local government of the city is vested in a mixed commission composed of Europeans and Egyptians in equal numbers. Population, ca. 125,000.

Portsmouth (*pôr't-mûsh*), a city in Rockingham County, New Hampshire, on the Atlantic Ocean, at the mouth of the Piscataqua River, ca. 50 m. s.w. of Boston. It is served by the Boston and Maine R.R. Portsmouth, a port of entry, is the only seaport in New Hampshire, handling mainly bulk cargoes, and serves as a commercial center for the surrounding agricultural and resort area. Manufactures include shoes, gypsum products, buttons, beer, paper, and matches. The U.S. naval base on Fernald's and Seavey's Island in the Piscataqua River has important submarine-building and repair facilities. Pease Air Force Base is located just west of the city.

Portsmouth contains many historic houses,

PORTSMOUTH

outstanding examples of Colonial-Georgian architecture, which are open to the public during the summer months. First settled in 1631 as Piscataqua and later called Strawberry Bank, Portsmouth was incorporated as a town in 1653 under its present name. It became a city in 1849. The Portsmouth Treaty (*q.v.*) was concluded here in 1905. Population, 1940, 14,821; in 1960, 25,833.

Portsmouth, a city in southern Ohio, seat of Scioto County, on the Ohio River at the mouth of the Scioto River. It is on the Chesapeake and Ohio the Norfolk and Western, and the Baltimore & Ohio R.R.'s. Portsmouth is a trading center for the Ohio and Scioto river valleys, and the surrounding country is a farming and dairying region. Among the city's manufactures are steel-mill products, shoes, chemicals, wood lasts, plastics, transportation equipment, and refractory brick. An atomic-energy plant nearby (at Piketon) was completed in 1955. Clay deposits are mined and sandstone quarried in the vicinity. A division of Ohio Univ. is located here, and the Shawnee State Forest (33,419 acres) and the Roosevelt Game Preserve are a short distance from the city.

Settled in 1803 and incorporated as a town in 1814, Portsmouth became a city in 1851. At one time, it was an important port on the Ohio and Erie Canal. After the decline of river traffic, the city gained much prosperity as a railroad hub. Population, 1940, 40,466; in 1960, 33,637.

Portsmouth, a city in southeastern Virginia, on the west side of the Elizabeth River, opposite Norfolk (*q.v.*), Va. Portsmouth is on the Seaboard Air Line, the Atlantic Coast Line, and other railroads. It forms part of the Port of Hampton Roads, one of the finest natural harbors in the U.S. See also *Hampton Roads*.

Portsmouth is the seat of the headquarters of the 5th Naval District, and its economy is largely influenced by the Navy installation maintained



Courtesy British Information Services

PORTSMOUTH, ENGLAND

here. The city's industries include shipbuilding and repair, fisheries and seafood processing, and the manufacture of chemicals and machinery. A part of the Norfolk-Portsmouth standard metropolitan statistical area, the city had (1958) a value added by manufacture of \$16,216,000.

The Norfolk Naval Shipyard (1767) and the Naval Hospital (1830) are the oldest in the U.S. Other noteworthy relics of Portsmouth's colonial past include Trinity Church (1762) and the Watts House (1799).

Portsmouth was established in 1752 and chartered as an independent city—separated from county government—in 1858. The city was burned by the British in 1779 and suffered damage during the Civil War. Portsmouth's decade of greatest growth was 1950-60, when the population rose from 80,039 to 144,733, increasing 80.9 per cent.

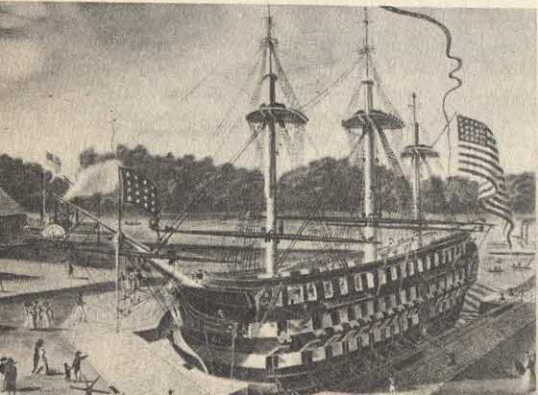
Portsmouth, a county borough, seaport, and naval base, in Hampshire, England, about 74 m. s.w. of London. The present city of Portsmouth results from the amalgamation of four towns, Portsmouth proper (where the naval garrison is located), Portsea (the site of the naval dockyard), Landport (a residential section), and Southsea (a seaside resort and residential area). The city is located on the island of Portsea, which lies between two inlets of the English Channel. The more westerly of these inlets is Portsmouth Harbour; its entrance is extremely narrow, but it has a wide and deep basin which affords anchorage for the largest ships. Beyond the harbor is Spithead, one of the arms of the channel that separates the Isle of Wight from the mainland.

The economy of Portsmouth is largely dependent

DRYDOCK AT PORTSMOUTH, VA.

A contemporary illustration shows the 74-gun *Dela-ware* going into drydock at the Norfolk Naval Shipyard, on June 17, 1833. Not fully completed at that time, the drydock is still in use

Official U.S. Navy Photo



upon the Royal Navy which maintains its chief home base here. Many of the residents are pensioners and servicemen's dependents. In addition to the shipbuilding and repair facilities of the Royal Navy, Portsmouth has aircraft plants and small clothing factories. The commercial use of the port is limited.

Portsmouth is said to owe its existence to the retreat of the sea from Porchester, where the Romans had once erected coastal fortifications. The town was built, in the 12th century, on its present site on the island of Portsea by Richard I. King John established a naval station here, and dockyards were built in the reign of Henry VIII. In 1782 H.M.S. *Royal George*, one of the finest ships in the British fleet, sank in the harbor, drowning Adm. Richard Kempenfelt (1718-82) and about 800 men. Lord Nelson's flagship, H.M.S. *Victory*, on which he was killed at Trafalgar in 1805, lies in dry dock here. It is a museum and also serves as the flagship for the commander in chief of the Portsmouth naval base. Charles Dickens was born here, and his birthplace is now a museum, housing relics of the novelist. Another landmark is the cathedral (founded in 1927), which includes parts of a 12th-century church and other early structures; the cathedral is still not completed.

Portsmouth suffered severely from German air raids during World War II. It has been estimated that about 93 per cent of the houses in the city were damaged, and many of these were a total loss. Some of the chief shopping streets were destroyed, as were many public buildings, including the 700-year-old Garrison Church where Charles II was married (1662) to Catherine of Braganza. Portsmouth's reconstruction, however, is considered a model of modern city planning.

Population, 1901, 188,133; in 1941, 252,421; in 1951, 233,545.

Portsmouth Treaty (*pōrts'mūth trē'tī*), a treaty signed at Portsmouth, N.H., Sept. 5, 1905, terminating the Russo-Japanese War. Its provisions included Japanese "protection" of Korea; evacuation of Manchuria by both Russia and Japan; cession of Russian rights to the Manchurian Ry. from Port Arthur to Kwangchentze, as well as mining and other rights; and Japanese control of Port Arthur. Brought about largely through the efforts of President Theodore Roosevelt, for which he was awarded the Nobel Peace Prize, the Portsmouth Treaty nevertheless aroused much dissatisfaction among the Japanese, even though they had won many benefits. Internal disorders followed the settlement in both Russia and Japan. See also *Japan*.

Port Townsend (*pōrt toun'zənd*), county seat of Jefferson County, Washington, 35 m. n.w. of Seattle. It is situated on the west coast of

Puget Sound, near the Strait of Juan de Fuca, and on the Chicago, Milwaukee, St. Paul & Pacific R.R. The harbor is safe and large, and owing to its location within the influence of the Japan Current, the city has a pleasant, equable climate. It has a large trade in grain, fish, lumber, and minerals. It was first settled in 1851 and was incorporated in 1860. Population, 1940, 4,683; in 1950, 6,888.

Portugal (*pōr'tū-gal*), a country of Europe, occupying the southwestern part of the Iberian peninsula. It is bounded on the n. and e. by Spain and on the s. and w. by the Atlantic Ocean. The length from north to south is 350 m.; the average width, 110 m.; and the area, 35,413 sq. m., including the Azores and the Madeira Islands.

DESCRIPTION. The surface is diversified by a chain of mountains running from southwest to northeast. This elevated region includes the Sierra de Estrella, which is a chain of the Sierra Guadarrama of Spain. This range is between the Douro and the Tagus rivers, and foothills and offshoots extend from it in many directions. The greatest elevation is about 6,500 ft. above sea level. The coast line, including indentations, has a length of 465 m. A large part of the coast lands rise quite abruptly from the sea, but in some places the coastal tracts are sandy and low. A greater part of the Atlantic slope is included within Portugal, but much of it is a tableland of considerable elevation.

The drainage is exclusively to the west and south. Both the Douro and the Tagus, the two largest rivers, enter the country from Spain and flow into the Atlantic. The Sado, which rises in the southern part, has a general course toward the north and flows into the Setubal Bay. A part of the eastern boundary is formed by the Guadiana, which flows into the Atlantic on the border with Spain. Few of the rivers are navigable, but seagoing vessels ascend the Douro to Porto and the Tagus for a distance of 90 m. A part of the northern boundary is formed by the Minho, which has a wide and fertile valley.

In general the climate is healthful and the winters are short and mild. Vegetation is not interrupted to a great extent in the southern part, but in midsummer, in July and August, the country is generally dry. At Lisbon the mean temperature is 60°; the city has a rainfall of 40 in. per year, but midway between that city and Porto the precipitation is greater than in any other part of Europe, averaging about 180 in. The soil as a whole is somewhat sandy and not highly productive, but many of the valleys and plains are noted for their fertility. Snow remains the greater part of the year on the mountains of the northern part, where the summer season is shorter than farther south, although the dry part of the year is less extended. Spring begins early in January

PORTUGAL

in the southern part, where vegetation grows abundantly in February.

MINING. Although rich in minerals, Portugal has not developed mining to the extent that its resources justify. Coal, copper, sulfur, pyrites, wolfram, and tin are mined, the last three in exportable quantities.

AGRICULTURE. Portugal has extensive vegetation, much of it of natural growth. About a quarter of the land surface is covered with forests which yield considerable quantities of pine, oak, and chestnut as well as a large production of cork, resin, and turpentine for export. About 60 per cent of the surface is fit for cultivation. Vine culture is an important industry, accounting for the large manufacture and export of wine. A superior grade of cereals is produced, but the yield does not meet the demand of home consumption. Wheat, corn, rye, potatoes, barley, rice, and oats are grown profitably, as are many fruits and vegetables. Portugal is one of the leading olive-producing countries and annually exports over 10,000,000 gallons of oil.

Farming is conducted on a diversified basis. Sheep and goats are raised in considerable numbers. Both cattle and goats are grown for meat and dairying purposes. Other livestock include swine, horses, mules, and poultry. Oxen are used extensively as beasts of burden.

MANUFACTURES. Portugal is one of the leading wine-producing countries (especially of port), both in quality and quantity. The fisheries are an important industry, yielding much anchovy, tuna, and sardine. Cotton and woolen goods and silk textiles rank among the chief manufactures. Other products include porcelain tiles, processed cork, and embroideries. Porto and Lisbon are the principal manufacturing and trading centers.

TRANSPORTATION AND COMMERCE. Railways are operated in most sections of the country, but transportation shortages are still apparent. There are about 2,250 m. of railroads and about 17,750 m. of roads. Portugal has numerous good harbors, and regular ocean communication is maintained with all parts of the world, as well as airline connections. The country's national income is about 55,000,000,000 escudos (see table under *Coinage* for par value); and the per capita income was estimated (1957) at \$204. Great Britain, Germany, the U.S., and Belgium have the largest trade with Portugal, but imports generally exceed exports. Leading imports are wheat, raw cotton, coal, sugar, and motor vehicles; leading exports are cork, wine, sardines, olive oil, and naval stores.

POPULATION. The density of population is about 254 to the square mile. Only a small number of foreigners live in the country, mostly Spaniards and Brazilians. Emigration is chiefly to Brazil, and the U.S. Lisbon (1950 population, 790,434),

PORTUGAL

on the Tagus River, is the capital and largest city. Other cities include Porto (or Oporto), Setúbal, Coimbra, Braga, Évora, and Covilhã (in order of population). Population (1961 est.), 9,167,000.

BREAKDOWN OF AREA AND POPULATION

Districts and Provinces	Capital	Area (sq. m.)	Population 1950 census
DISTRICTS			
Angra de Heroísmo ¹		268	86,577
Aveiro		1,070	477,191
Beja		3,969	286,803
Braga		1,054	541,377
Bragança		2,526	227,125
Castelo Branco		2,588	320,279
Coimbra		1,527	432,044
Évora	The capital city has the same name as the district	2,853	219,638
Faro ²		1,958	325,971
Funchal ³		302	266,990
Guarda		2,122	304,368
Horta ¹		294	54,823
Leiria		1,326	389,182
Lisboa (Lisbon)		1,061	1,226,815
Ponta Delgada ¹		326	176,009
Portalegre		2,368	196,993
Porto (Oporto)		881	1,052,663
Santarém		2,583	453,192
Setúbal		1,971	324,186
Viana do Castelo		814	274,532
Vila Real		1,636	317,372
Viseu		1,933	487,182
PROVINCES			
Algarve	Faro	1,958	325,971
Alto Alentejo	Évora	4,888	394,789
Baixo Alentejo	Beja	5,318	375,147
Beira Alta	Viseu	4,055	691,713
Beira Baixa	Castelo Branco	2,897	355,806
Beira Litoral	Coimbra	3,924	969,166
Douro Litoral	Porto (Oporto)	1,269	1,237,170
Estremadura	Lisbon	2,064	1,595,067
Minho	Braga	1,868	815,909
Ribatejo	Santarém	2,794	459,853
Trás-os-Montes e Alto Douro	Vila Real	4,162	636,322

¹ In Azores. ² Coextensive with Algarve. ³ Coextensive with Madeira Islands.

OVERSEAS AREAS. Portugal became a colonial power at the end of the 15th century, but about half a century later this power began to decline. Colonies were established in Africa, on the sub-continent of India, and in other parts of the world, and between 1500 and 1822 Brazil was a possession of Portugal. After the annexation of Dadrá and Nagar Aveli and the seizure of Damão, Diu, and Gôa by India in 1961, Portugal's remaining overseas areas comprised Macao in China, the eastern portion of Timor in the Malay Archipelago, Cape Verde Islands, Portuguese Guinea, the islands of São Tomé and Príncipe off the western coast of Africa, Angola in West Africa, and Mozambique in East Africa. The total area of Portuguese possessions in 1959 was 802,347 sq. m., and the total population, 13,044,000.

EDUCATION. Primary education has been compulsory for over a century, although numerous exceptions have long been permitted. Portugal's illiteracy rate is one of the highest in Europe—44 per cent of her adult population in 1950. About 900,000 pupils study in about 17,500 primary schools; about 170,000 students are instructed in about 300 secondary and vocational training schools. Institutions of higher learning include the universities of Coimbra, Porto, and Lisbon, with a combined enrollment of about 14,000.

GOVERNMENT. Portugal has been a republic since 1910, when a revolution deposed the monarch. A constitution was adopted the next year, remaining in force until 1933, when a new supreme law was promulgated, providing for an authoritarian, corporative state. The executive branch is headed by a president, elected for a seven-year term by an electoral college composed of members of the national assembly and the corporative chamber and representatives of the municipalities and overseas territories. A 16-member state council, or cabinet (headed by a premier), assists the president. A one-chamber national assembly of 130 members is elected by popular vote once in four years; a corporative chamber representing various economic and social groups serves alongside the assembly in an advisory capacity. In all elections the government presents a slate of candidates which is virtually assured of victory, although—in theory—rival candidates are permitted to compete.

Military service for 18 months is compulsory for men between 20 and 45. The army comprises ca. 45,000 officers and men; the navy, ca. 10,000; and the air force, ca. 3,000.

LANGUAGE AND LITERATURE. The Portuguese language is one of the Romance languages, descended from Latin. It is spoken in Portugal and Brazil and resembles Spanish in many respects. The languages spoken in Portugal and Spain up to the time of Alfonso I (Portuguese form, *Alfonso*) were very similar, but at that time the Castilian dialect became the language of Spain and the Galician dialect quite largely influenced the language of Portugal. The difference in language was one of the causes of hostility between the two countries, and each developed distinct spoken and written forms.

Many valuable literary works have been written in the language of Portugal. The earliest writings date from the 13th century and had their focus in the royal court, especially after the accession of Alfonso III in 1248. The alliance between literature and the nobility was further strengthened by the writings of and the collections of poetry made by King Diniz. Pedro I was among the early poets, while the sons and grand-

sons of John I produced a number of poetical works of value. Fernão Lopes (1380-1459) published the "History of Portugal" in 1425, and António de Ferreira wrote "Inês de Castro," an excellent tragedy, about 1558. In that period, the Portuguese language became further distinguished from the others spoken in the Iberian peninsula, and vast explorations in foreign lands inspired poets to laud Portuguese heroes.

Among the great writers of the 16th century, who wrote much of the classical literature of Portugal, may be included Ferreira, Sá de Miranda, Brandão, Gil Vicente, and Camões, the last named being the author of dramas, sonnets, songs, and a great Renaissance epic entitled "*Os Lusíadas*." João de Barros, an eminent historian of the 16th century, wrote a grandiose account of the Portuguese in Asia. The writers of the 17th and 18th centuries were influenced first by Spanish and later by French scholars; in the time of Louis XVI they became quite imitative. Interest in literature was greatly augmented in the early part of the 19th century by the poetry of Barbosa du Bocage and Francisco do Nascimento, both of whom were forerunners of distinct schools of romanticism. Alexandre Herculano (1810-77) was the most noted historian and historical novelist of 19th-century Portugal. The dominant Portuguese romanticist, Almeida Garrett (1799-1854), Tomás Ribeiro (1831-1901), Luís da Silva (1822-71), Júlio Dinis (1839-71), and António de Castilho (1800-75) were well-known figures. Naturalism, which influenced literature throughout the Western world after the middle of the 19th century, was introduced into Portugal by José Maria de Eça de Queirós (1845-1900), still considered Portugal's greatest modern novelist.

Portuguese poetry of the 20th century has been influenced by the somewhat morbid António Nobre (1867-1900), the nationalist Teixeira de Pascoais (1878-1953), and Fernando Pessoa (1888-1935). One of the foremost contemporary authors is Miguel Torga (1907-), who has written poetry, short stories, and dramas.

HISTORY. The earliest history of Portugal was recorded by the Phoenicians, Greeks, and Carthaginians, who traded along its coasts and established colonies in various parts of the Iberian peninsula. Its ancient name was Lusitania, and the original inhabitants were known as Lusitanians. The region was conquered by the Romans and was held as a dependency for many centuries, but after the decline of Rome it was successively overrun by the Alans, Goths, and Vandals. In the 8th century the Moors conquered it and introduced their form of civilization. For nearly 400 years the Moors remained the predominating influence, but they were finally conquered in 1139, and Alfonso I organized an independent



PORTUGAL—ANCIENT AND MODERN

At Coimbra (above), Roman ruins are carefully preserved (*Sherman and Betty Ravenson*). Other remnants of the past can be seen in the architecture bordering the narrow street (left), typical of Tavira, and in the stairway leading to St. George's Castle (below left), in Lisbon (*second photo, Sni-Yan*). Also in Lisbon, however, is (below right) the modern residential Hotel Infante Santo (all photos on both pages, courtesy Casa de Portugal, N.Y.)





PRESENT-DAY PORTUGAL

The shrine at Fátima attracts many pilgrims annually; above is the basilica at night (*photo Sni-Yan*). The government of Portugal rests in the hands of a premier and a president (*right*), currently, Premier Antonio de Oliveira Salazar and Pres. Americo de Deus Tomas (*far right*). Portugal's economy is largely dependent on nature, on, for instance, cork (*below left*) and sardines (*below right; Sni-Yan*),



kingdom* in 1143. The country at first included only the region between the Minho and Douro, but Alfonso enlarged the border by defeating the King of Castile, and thereby extended his dominion beyond the Tagus. In 1143 he annexed Algarve and Santarem. Lisbon was captured with the aid of the Crusaders in 1147.

Between the latter part of the 14th and the early part of the 16th centuries Portugal ranked as one of the greatest countries of Europe. Its proud position was attained in the successful reign of King John I, whose son was Prince Henry the Navigator. Portugal obtained a code of laws and a constitution, industrial arts were encouraged, and a great navy was established. Many colleges and institutions of learning were founded, and all were liberally attended. The fleet sailed upon all the seas known at that time, Lisbon became the most noted commercial center for Eastern products, and the navigators discovered and explored many parts of Africa and the South Sea Islands. In 1486 Bartolomeu Diaz doubled the Cape of Good Hope, India was reached by Vasco da Gama in 1498, and Brazil was claimed for the crown by Cabral in 1500. The Spanish explorers were active at the same time. The jealousies that arose between the two nations caused many conflicts, and in 1580 Philip II of Spain gained the victory of Alcantara and annexed Portugal to his kingdom.

The Portuguese did not finally regain their independence until 1640; the Spanish did not recognize their country as independent until 1668. While Portugal and Spain were at war, the Dutch were induced by hostile measures of Philip to make continuous attacks upon the colonial possessions of both countries. During this period Portugal lost the Moluccas and its settlements in Malacca, Guinea, Ceylon, and a portion of Brazil, but the last named was afterward restored to Portugal. Portugal lost its position as a great maritime power, while its finances were almost ruined and the people sank into ignorance and bigotry. Joseph I succeeded to the throne in 1750. The Marquis of Pombal, his chief minister, sought to restore national credit and prosperity by making many reforms, but the affairs of the nation passed to the eldest daughter of Joseph, Maria Isabella, in 1777. She governed inefficiently until 1792, when it became necessary to make her eldest son John, Prince of Brazil, regent. Portugal's friendly relations with England led to an attempt at conquest by Napoleon; after a French force under Junot occupied Portugal, the royal family transferred the seat of government to Rio de Janeiro, Brazil, in 1807.

John VI ascended the throne of Portugal and Brazil on the death of Maria, in 1816, but he continued to reside in the latter country, while the government at home was mismanaged by

his officers. In 1820 a revolution was followed by the establishment of a constitution, but the king was invited to return, which he did soon after. Brazil declared its independence from Portugal in 1822 and proclaimed the son of John VI, Dom Pedro, as emperor. King John died in 1826, and the Emperor of Brazil became Dom Pedro IV of Portugal, but the government was administered under Infanta Isabella Maria as regent. A constitution modeled after that of France was adopted in 1826, and Dom Pedro at once abdicated the throne of Portugal in favor of his daughter, Maria da Gloria, on condition that she marry Dom Miguel, who was named regent. A revolution in favor of Miguel caused him to be declared king by the Cortes.

Dom Pedro resigned as Emperor of Brazil in 1831 and returned to Europe to effect the overthrow of Dom Miguel. He succeeded in restoring Maria in 1833. She governed until her death in 1853, when her son, Dom Pedro V, became king under the regency of her husband. Pedro ruled from 1855 to his death (1861) and was succeeded by his brother, Louis I. The latter died in 1889. Under his son, Carlos I, the country experienced an era of considerable prosperity and progress. However, he and his eldest son, Luiz Philippe, were assassinated by revolutionists on Feb. 1, 1908, when his second son, Manuel II (1889-1932), ascended the throne. A republican revolution, aided by an uprising of the army and navy, deposed the king in 1910, and in the following year a constitutional republic was established. Manoel de Arriaga, long a leader of the republican movement, was elected first president. His administration enacted a series of anti-clerical laws which culminated in a breach of diplomatic relations with the Vatican. Religious orders were suppressed and their property confiscated; free and secular education was introduced, but although nominally compulsory, school attendance was not generally enforced.

In 1916 the country entered World War I on the side of the Allies, after having pursued a policy of friendly neutrality. The progress made under the early years of the republic was feeble and tentative; many elements remained unreconciled, and the continuous intrigues and political maneuvers finally led to the collapse of all attempts at democratic government and the institution of an authoritarian regime.

A *coup d'état* on May 28, 1926, put the army in control of the government and brought about a military dictatorship whose leadership quickly passed into the hands of Dr. Antonio de Oliveira Salazar, a professor of economics. Dr. Salazar reformed the tottering financial structure of the nation and set the pattern for the *Estado Novo* (New State) whose existence was formalized on March 19, 1933, with the adoption of a new



AMPHIBIANS OF NORTH AMERICA

1. Gopher Frog (*Rana aesopus* Cope) Florida 2. Leopard Frog (*Rana pipiens* Shreber) East of Sierra Nevada Mts. 3. Spotted Newt (*Triturus viridescens*) Eastern U.S., Canada 4. Rocky Mountain Toad (*Bufo L. woodhousei* Bd. and Gird.) Rocky Mt. region 5. Spotted Salamander (*Ambystoma maculatum*) Eastern and Central N.A.

[Approx. original size]



VENOMOUS AND CONSTRICTOR SNAKES

1. Southern Milk Snake (*Ophibolus doliaus clericus*) Maryland to Florida, west to Texas [2 ft. long]
2. Florida Diamond-Back Rattlesnake (*Crotalus adamanteus*) Florida and Georgia [6-8 ft. long] venomous
3. Reticulated Python (*Python reticulatus*) Burma, Indo-China, and Malaysia [28-33 ft. long]



Photo by B. Holmes, courtesy Ewing Galloway, N. Y

VIEW OF PORTO, THE CHIEF SEAPORT OF PORTUGAL

constitution. General Antonio Oscar de Frago de Carmona, who had been elected to the presidency in 1926, remained in office until his death in 1951, but the real power remained with Dr. Salazar, who had become premier in 1932 and who retained the post under the *Estado Novo*.

During the civil war in Spain (1936-39), official Portugal, although friendly to Gen. Franco's movement, joined England and other powers in the policy of "non-intervention" in Spain. Portugal, however, early recognized the Franco regime, and the two governments entered a Treaty of Friendship, which, in 1940, was extended to safeguard the neutrality of both nations in World War II. The occupation of Portuguese Timor, first by Allied and then by Japanese troops, put a strain on Portuguese neutrality, but did not become a critical issue. More serious in terms of Portugal's relations with the warring powers was the invocation (Oct. 12, 1943) of a 570-year-old treaty under which Great Britain received naval bases in the Azores. Similar privileges were also granted to U.S. ships. Portugal's application for membership in the U.N. has been denied as the result of a Soviet-Western controversy. Portugal joined in the European Recovery Program (*q.v.*), however, and in 1949 signed the North Atlantic Treaty (*q.v.*). Against long-standing opposition by Soviet Russia, Portugal was admitted to the U.N. in 1955. Portugal also joined the European Free Trade Assn., a group of Western European countries which did not wish to associate themselves with the European Common Market. Presi-

dent Dwight D. Eisenhower, of the U.S., visited Lisbon in 1960.

Marshal Francisco Higinio Craveiro Lopes was president, 1951-58, and was succeeded by Rear Admiral Américo de Deus Rodrigues Tomás. In recent years, resistance to authoritarian rule, although ineffectual and often overdramatic, began to mount. Mostly centered around a former general and presidential candidate, Humberto Delgado, the opposition tried to arouse worldwide attention by seizing a Portuguese liner on the high seas in 1961. More immediately felt and serious, however, were native uprisings in Angola and Mozambique, which were ruthlessly suppressed by the Salazar administration; but its African policy was opposed in the U.N. and criticized in the U.S.

Portuguese East Africa (*pôr'tû-gêz*) or MOZAMBIQUE, an overseas province of Portugal in southeast Africa, bounded on the n. by Nyasaland and Tanganyika, e. by the Indian Ocean and the Mozambique Channel, s. by Natal, w. by Transvaal and Southern Rhodesia, and n. and n.w. by Northern Rhodesia. Its area is 297,731 sq. m., which is divided into four provinces, Sul do Save, Manica and Sofala, Zambesia, and Niassa. The low coastal terrain of the south gives way to mountainous regions in the north, some of the peaks rising almost 9,000 ft. Mozambique is crossed near its central portion by the lower course of the Zambezi River, which acts as a natural barrier to the local fauna, that found on the north side differing from that on

the south. Other important rivers are the Limpopo, the Save, and the Lugenda. The fertile coastal plains produce sugar, corn, cotton, copra, tobacco, rubber, coffee, tea, and sisal products. Various minerals, such as gold, silver, and uranium, are mined by native labor in the more healthful northern region. Lourenço Marques (pop., ca. 50,000), a seaport city on Delagoa Bay, is the capital; Beira (pop., ca. 25,000), on the east coast of the province, is another seaport of importance.

Under Arab domination until the end of the 15th century, Mozambique was explored by Vasco da Gama and claimed for Portugal. In the early 16th century it was a Portuguese trading center, but little attention was devoted to its development until many years later. An agreement with Britain regarding its boundaries in relation to South and East Africa was reached in 1891, at which time the Mozambique Co. was chartered. The boundaries with German East Africa were defined three years later, and Mozambique was organized as a colony in 1904. Until 1942 part of the territory was under Portuguese administration, while the districts of Manica and Sofala were administered by the Mozambique Co. When their charter expired in 1942, the territory reverted to the Portuguese government. The province is administered by a governor, assisted by a government council of representatives, elected from the various occupational classes, and an executive council, who is responsible to the central government in Lisbon. Population, 1950, 5,737,767.

Portuguese Guinea (*pōr'tū-gēz gīn'i*), an overseas province of Portugal, on the western coast of Africa, bounded on the n. by Senegal, e. and s. by French Guinea, and w. by the Atlantic Ocean. A number of small islands off the coast, including the Bissagos, belong to it. The entire area is 13,948 sq. m. From the coasts the land rises gradually toward the mountains of French Guinea, and the drainage is chiefly by the Rio Grande, which enters the sea by a wide estuary. It has a tropical climate and valuable timber, including many varieties of the palm tree. Rice, ivory, wax, oil, nuts, seeds, hides, and rubber are the principal products. The area has been a possession of Portugal since its discovery in 1446, but its boundaries were not established until 1886. The capital and the chief port is Bissau (pop., ca. 1,000). The inhabitants of the province consist of about an equal number of half-castes and Europeans and some Negroes and Indians. Population, 1950, 510,777.

Portuguese Man-of-War (*pōr'tū-gēz mǎn-ōf-uǎr'*), member of the class of polyps and jellyfishes. It attains lengths up to 6 inches, and is able to float on the water by inflating a bladder; it is covered by a colony of small animals on

which it feeds. With its tentacles it catches and benumbs its prey. It is at home in tropical seas.

Portuguese West Africa OF ANGOLA, an overseas province of Portugal, on the west coast of Africa, extending ca. 1,000 m. along the Atlantic Ocean between the Congo River on the n. and the Cunene River to the s. The Belgian Congo lies to the n. and n.e. borders; Northern Rhodesia bounds it on the e., and Southwest Africa on the s. Angola has an area of 481,351 sq. m., most of which is desert plateau. The generally high temperature, due to the country's proximity to the Equator, is relieved in many areas of the highland plateaus, which are at least 4,000 ft. above sea level. Heavy rainfall in the valleys of Angola's northwest corner encourage the growth of forests of hardwoods. Agriculture, stock raising, and fishing are the main economic activities, the temperate highlands affording favorable conditions for the breeding of sheep, cattle, goats, horses, and hogs. The varying climate permits a diversity of crops. Beans, tobacco, sisal, and corn are cultivated by the natives; coffee, sugar cane, and cotton are grown for export on plantations managed primarily by Europeans.

Luanda, the capital and chief seaport (pop., ca. 135,000), enjoys an extensive import-export trade, being well served by railroads and other facilities. Besides its heavy export traffic in plantation crops, Angola carries on a moderate trade in diamonds. Settled by Portugal in the 15th century, Angola has since been under Portuguese control, except for a short occupation by the Dutch (1641-48). Since the country's economic potentials have been largely untapped, due to a lack of capital and local interest, many of its businesses are owned by foreigners. Angola is administered by a governor general, responsible to the Portuguese government at Lisbon. Population, 1950, 4,111,796.

Port Wine (*pōrt wīn*), a popular dessert wine, first produced in the upper Douro River valley in Portugal, and named for its shipping point, Porto. The principal types of port are *tawny* and *ruby*. The generic name *port* is also given to wines of other countries, but the point of origin must be stated on the label.

Port is a sweet, rich, fruity, heavy-bodied wine, ranging from 9 to 14 per cent in natural grape sugar by weight. Although some white port is produced by using only white grapes, port is generally red.

The highest grade of port wine is sold as *vintage port* after aging in casks for about two years. Tawny port is a blend of as many as 30 wines, and it is aged much longer than ruby. In the wine-making process, tawny port loses much of its original color. See *Wine*.

Poseidon (*pō-sī-dōn*). See *Neptune*.

Posen (pō'zen). See *Poznań*.

Positivism (pōs'i-tiv-iz'm), a term signifying a movement in philosophy based on ideas of Auguste Comte (q.v.). Essentially, it goes back to Bacon and in some ways to Hume, in so far as it denies the sense of looking for a First Cause and is definitely against any metaphysics. It represents a typical 19th-century philosophy with its concentration on scientifically observable facts and its emphasis on discoveries of physical science. According to positivism, only the methods of natural science are scientific, and natural laws—and they alone—order the processes of the world. Any speculation is superfluous, since it cannot help our knowledge, which can be augmented only by further experiences. Peculiarly, this strongly antimetaphysical philosophy developed nevertheless almost into a religious movement, where the sociological concept of "humanity" took the place of God. The hierarchical order of the Catholic Church was completely taken over, the only modification being that the scientist or the intellectual substituted for the priest. This primitive mechanistic concept in its religionized form wielded a large influence in the 19th century, and modern pragmatism is still indirectly influenced by it.

Positron (pōs'i-trōn), a sub-atomic particle, similar to the electron except that it bears a positive charge. It is also called a positive electron. It was first identified by Carl D. Anderson, in 1933, in cloud-chamber photographs made during the study of cosmic rays. The mass of the positron, like that of the electron, is $1/1850$ of the mass of the hydrogen atom, or 9.1×10^{-28} gram. The passage of gamma rays through a cloud chamber frequently reveals a pair of particles, the electron and its mate the positron, which are deflected to the left and right, respectively, by the magnetic field. Whenever a positron and electron meet, they combine in a blaze of light, emitting energy of 1.1 mev (million electron volts), which is the amount of energy in a gamma-ray quantum. Thus the mass and energy combined of these two particles is converted into pure energy.

Post (pōst), EMILY (née PRICE), novelist and authority on etiquette, born in Baltimore, Md., Oct. 3, 1873; died in New York, N.Y., Sept. 25, 1960. Born to social position and educated in private schools, Mrs. Post was obliged, by divorce, to support herself by writing novels, e.g., "The Flight of the Moth" (1904), "Purple and Fine Linen" (1906), and "The Title Market" (1909). An editor then suggested that she write "Etiquette" (1922, and frequently revised). Its success was followed by "How to Behave Though a Debutante" (1928), "The Personality of a House" (1930), and "Children are People" (1940); a series of radio talks (from 1931); a daily column



EMILY POST

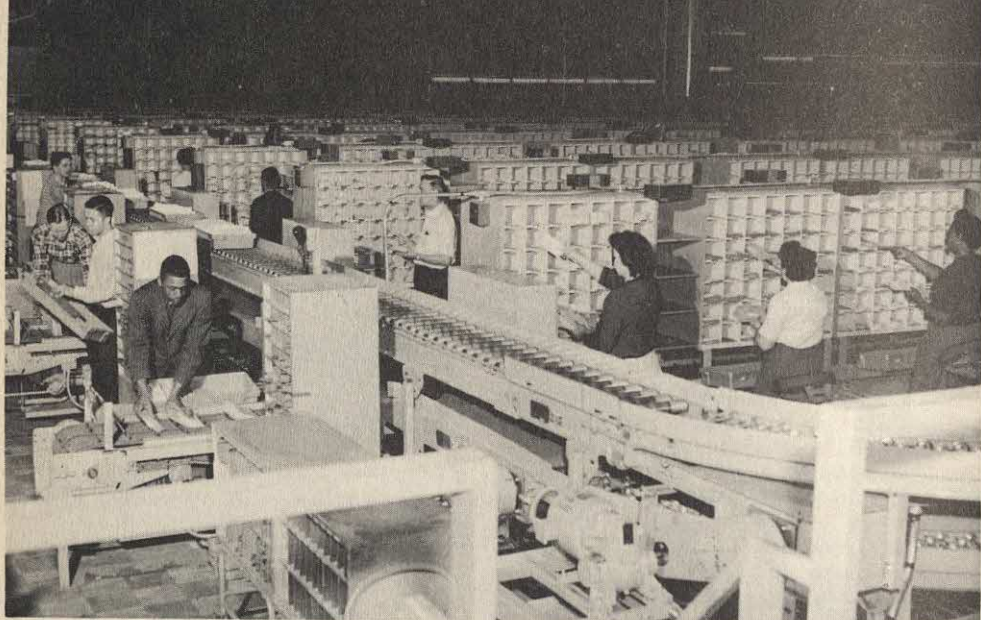
syndicated in 160 newspapers (from 1932); and the *Emily Post Inst.*, directed (since 1946) by Emily Post's son, Edwin M. Post, Jr.

Post, WILEY, aviator, born in Van Zandt County, Texas, in 1899; died in 1935. An oil driller in his youth, he lost the sight of one eye in this occupation. During the National Air Races of 1930, he piloted the monoplane *Winnie Mae* from Los Angeles to Chicago in slightly more than nine hours to win the feature of the derby. With Harold Gatty, he piloted the *Winnie Mae* around the world in 1931. He died in 1935, when his plane crashed in Alaska. Will Rogers (q.v.), humorist, also died in this crash.

Postal Savings System (pōs'tal sāv'ingz sī'stēm), a public thrift system available to persons with small savings. The U.S. created (1910) a postal savings system, which is under the management of a board of trustees consisting of the Postmaster General and the Secretary of the Treasury.

An account may be opened by any person ten years of age or over in his or her own name. Deposits may be made in sums of \$5 or multiples thereof until the balance in favor of the depositor amounts to \$2,500. The deposits are evidenced by denominational certificates of deposit and the rate of interest is 2 per cent per annum. For small savings, U.S. Savings Stamps in denominations of 10, 25, 50 cents, \$1, and \$5 are available for purchase at most post offices. These stamps, when entered in an album furnished free for that purpose, may be redeemed for cash at any post office, or accepted in multiples of \$5 for deposit in a postal savings account at a postal depository office. Depositors are free to withdraw all or part of their savings at any time. There are 5,400 post offices, stations, and branches with facilities for postal savings, the total amount of savings being more than \$699,000,000, equal to an average of about \$500 for each of the 1,397,000 depositors.

Postal System (pōs'tal sī'stēm), the branch of the civil service of a government which is charged with carrying and delivering the mails. It is certain that systems for conveying intelligence among individuals and between individuals and officials were maintained in times of remote



Courtesy U.S. Post Office Dept.

MODERN POSTAL SYSTEM

The U.S. Post Office in Washington, D.C., employs the "Mail Flo" system for conveying letters between sorting areas, providing an enormous increase in the speed of mail distribution.

antiquity, but the first systematic institution having charge of dispatches was established by the Roman Empire, though the business transacted was wholly of a public character. The places at intervals along the roads of Rome, where couriers were stationed to bear dispatches, gave rise to the word *posts*, a term now generally applied in various ways by the several nations in connection with their postal systems. The Hanseatic League of European cities established the first extensive postal system of carrying letters and parcels as early as the 13th century.

In 1639 the general court of Massachusetts established the first post office in America, in the house of Richard Fairbanks. Governor Lovelace established the first post road between New York and Boston in 1672, and the mail made a round trip each month, but in 1702 the round trips were changed to twice a month. King William and Queen Mary granted a patent to Thomas Neale, in 1692, whereby he was made postmaster general for the colonies. In the same year a general post office was established in Virginia, and the next year one was founded at Philadelphia. Parliament established a uniform postal system for all the colonies in 1710, and the principal office in America was located at New York, but there were general post offices to receive and distribute mails for different points in other large cities. Benjamin Franklin was the first postmaster general to make the system a success, receiving his appointment in 1753, but he was deprived of his office in 1774 for his attitude in the American conflict.

In 1775 Congress adopted a plan for a colonial

postal system, which had been devised by William Goddard, and made Franklin the Postmaster General. Both the Articles of Confederation and the Constitution vested the power over postal affairs in Congress, and that body assumed full control of the mails under the new Federal government in 1789. Among the notable events in connection with the postal service of the U.S. are a postal treaty with England in 1846, the issuance of adhesive postage stamps in 1847, the introduction of stamped envelopes in 1853, the establishment of the registered-letter system in 1855, the introduction of free delivery in 1863, the establishment of the money-order system in 1864, the introduction of postal cards in 1873, the establishment of a special delivery system in 1885, the introduction of the two-cent reply postal card in 1892, and the revision of the postal money orders in 1900, 1905, 1951, and 1962.

Other important developments include the establishment of rural free delivery service in 1896, the establishment of the postal savings system in 1911, the establishment of the parcel post (long popular in Canada) in 1913, the inauguration of air mail (*q.v.*) service in 1918, the establishment of the cost-ascertainment system (by which revenue and cost of each class of mail and services is determined and proportionately allotted) in 1923, the introduction of special handling service in 1925, the establishment of bulk third-class mail rates in 1928, the introduction of air letter sheets in 1945, the establishment of domestic and international air parcel post service in 1948, and the inauguration of the certified mail service in 1955.

Under the free delivery system, carriers are em-

POSTAL SYSTEM

ployed by the government to deliver letters and other mail matter at the home or place of business indicated by the address. These carriers also collect the mail matter from boxes where it is deposited by the senders and convey it to the post offices. Originally free delivery systems were established only in cities having a population of 50,000, but this was rapidly extended to smaller cities, and culminated in the Rural Free Delivery (R.F.D.) system. A general system of free delivery is maintained in cities and most rural districts.

The growth and importance of the post office system of the U.S. may be noted from the following table.

YEAR	NUMBER POST OFFICES	REVENUE	EXPENDITURES
1790	75	\$ 37,935	\$ 32,140
1800	903	280,804	213,994
1810	2,300	551,864	495,969
1820	4,500	1,111,927	1,160,926
1830	8,450	1,850,583	1,932,708
1840	13,468	4,543,522	4,718,236
1850	18,417	5,499,985	5,212,953
1860	28,498	8,518,067	14,874,601
1870	38,492	18,879,537	23,998,838
1880	42,989	33,315,479	36,542,804
1890	62,401	60,882,098	66,259,548
1900	76,688	102,353,579	107,740,268
1930	49,063	705,485,098	803,667,219
1940	44,025	766,948,627	807,629,180
1950	41,464	1,677,486,967	2,222,949,000
1960	35,238	3,276,818,433	3,873,952,908

In 1942 the postal delivery zone number sys-

POSTAL SYSTEM

tem of addressing mail was inaugurated. The various geographical areas of a city are assigned a postal zone number, thus simplifying and expediting the delivery of mail, especially in the larger cities.

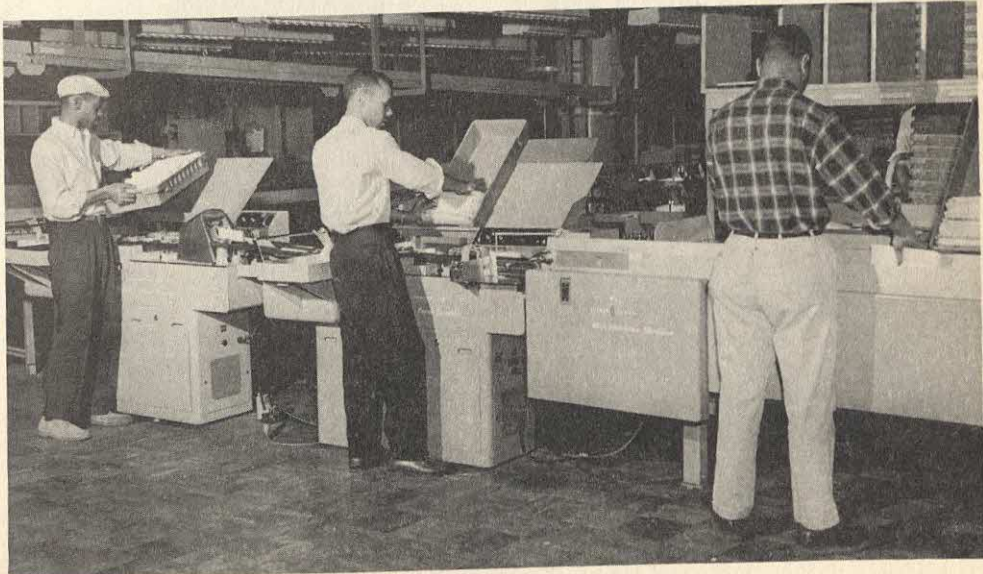
It is the intended policy of the government to make the postal system practically self-supporting, but expenditures have exceeded receipts much of the time. This is largely due to failure of postal rates to keep up with increasing wage and other cost levels.

The rate of postage on letters depended upon distance in the early period of postal regulations, varying from 8 to 25 cents per letter, but in 1816 the rates were set at from 6 to 25 cents. The rate on prepaid mail was fixed at 3 cents for all distances under 3,000 m. in 1851, but if not prepaid, 5 cents was collected on delivery. Congress passed a law in 1855 making the prepayment of postage compulsory, and a uniform rate of 3 cents for each half ounce or fraction thereof was established for all distances in 1863. The rate was reduced to 2 cents for each ounce or fraction thereof in 1885, and to 1 cent for drop letters, except in localities having free delivery, where the rate for drop letters remained at 2 cents. As a war measure, in 1917, letter postage was raised to 3 cents per ounce and postal card rates to 2 cents each. These rates were reduced in 1920, but letter rates were again raised in 1932. During World War II, rate increases were again put into effect. The domestic first-class postage rate is 5

AUTOMATION SPEEDS THE MAIL

High-speed machines cancel letters faster than the eye can follow in the mechanized Post Office in Washington, D.C. Other newly developed equipment contributes to the efficiency of the U.S. Postal system.

Courtesy U.S. Post Office Dept.





SEAL OF THE U.S. POST OFFICE DEPARTMENT

cents for a letter (up to 1 oz.) and 4 cents for a postal card; air-mail 8 cents per oz. Domestic rates apply to the territorial possessions.

All mailable matter is divided into four classes.

First-class mail includes letters, postal cards, and all matter wholly or partly in writing, with certain exceptions, as well as all matter sealed against inspection. *Third-class* matter includes books, circulars, and other matter wholly in print, proof sheets, corrected proof sheets, and manuscript copy accompanying same, merchandise, and all other mailable matter not included in the first and second classes, up to, and including, 16 ounces in weight. *Fourth-class* matter includes merchandise, books, printed matter, and all mailable matter not in the first or second class, exceeding 16 ounces in weight. The rates of postage on fourth-class matter are calculated by the pound, according to distance or zone. Postage on all mail matter must be prepaid. However, short-paid mail matter will be forwarded to destination, with the unpaid amount to be collected on delivery. Undeliverable letters bearing the address of the sender will be returned. All other matter, including postal cards, will be returned only when the matter bears the request of the sender for return. Mailable matter of the *second class* comprises newspapers and other periodical publications which have been formally entered as second-class mail, and which bear a notice of such entry. Books (as such) are not admissible as second-class mail. When mailed by the publishers at the post offices of entry, second-class matter is subject to a graduated distance zone rate on the advertising portion, and a flat rate on the reading portion. All matter may be registered by paying first-class postage, and registration fees. Any mail matter, failing of delivery, except circulars, advertisements, and other printed articles of no apparent value, is returned to the sender. The return is made direct to the sender if the matter bears upon the outside the name and address; otherwise it is sent to the dead-letter office, where it is opened and, if found to contain sufficient information, sent to the proper party upon collec-

POSTAL UNION

tion of a 10-cent dead mail fee. This is also true of parcels containing merchandise. If the owner is not found, they are sold at auction.

There are four general means of transporting the mails between post offices. They are: air, highway, rail, and water service. The major highway services are classified as star route (*q.v.*), mail messenger, and highway post office. Star route service is contract highway truck or vehicle service. Highway post office service provides for sorting of mail in bus-type vehicles in transit. Railroad services are classified as storage, which is movement of mail in carload and less than carload lots; and railway post office, which provides for sorting of mail in transit in specially designed railroad cars.

The post office system is under the direction of the Postmaster General, who is a member of the President's cabinet. Four classes of post offices are specified. The Deputy Postmaster General and five assistant postmasters general are appointed by the President. The salaries paid to postmasters filling Presidential post offices are graded according to the volume of business, while fourth-class postmasters are paid in proportion to the amount of business. Any attempt to interfere with the mails, or the commission of offenses relating to the post office business, such as embezzling, robbing, or destroying any mail matter, is punishable under Federal law.

Postal Union (*pōs'tal ūn'yūn*), an international agreement among almost all nations in regard to such postal matters as rates, services, etc. Originating at the Congress of Berne, Switzerland, in 1874, the idea culminated in the *International Postal Convention* of 1875. Since then, a congress has been held about every five years to discuss changes and developments. The Central Bureau of the Postal Union, located at Berne, is a clearing house for all necessary information, which is published in a monthly bulletin.

Negotiations for enlarging the South American Postal Union, founded Feb. 2, 1911, into a Pan American Postal Union were entered into during the Universal Postal Congress held in Madrid, Spain, in 1920. The so-called Spanish-American Postal Convention was concluded at Madrid, Nov. 13, 1920. The first Pan American Postal Congress was held in Buenos Aires, Argentina, in 1921, establishing the Pan American Postal Union. Spain was later admitted to the union, known as the Postal Union of the Americas and Spain; Canada (admitted still later), the U.S., and the Latin-American republics are the other members.

This union was formed to extend, facilitate, and perfect the postal relations of the signatory countries; and to establish a solidarity of action in the congresses, conferences, and other meetings of the Universal Postal Union insofar as it concerns communications by mail.

POSTER

Poster (*pōs'tēr*) OR PLACARD, a printed advertising bill which is posted on a wall or board. Such bills convey a message, commercial or artistic, political or religious, in a pictorial or verbal way. Simplicity and clarity of design are necessary to make them readable from a distance and understandable at a mere glance. William Caxton's first printed broadside (England, 1480), "advertising" a book, might be considered the "first" poster. With the development of printing and other means of mechanical reproduction, posters came into general usage. Modern poster design was begun in France at the end of the 19th century; French artists still lead poster art. Since posters are of transient use, there exists no special poster style, and poster designs follow the current trend in commercial and applied arts. For more illustrations see next page.

Postimpressionism (*pōst-īm-prēsh'ūn-iz'm*), in painting, term denoting the period and trend in art which was begun by Cézanne, Van Gogh, and Gauguin (*q.v.*), in reaction against Impressionism (*q.v.*). While the Impressionists tried to depict things as realistically as they saw them, by means of color and light, the Postimpressionists tried to solidify forms to certain structures and patterns. Through these tendencies they originated the elements out of which developed later movements in art—*e.g.*, Cubism, Constructivism, Futurism.

Postulate (*pōs'tū-lāt*). See *Theorem*.



Courtesy Metropolitan Museum of Art, N. Y.

FRENCH POSTER, 1892

By Henri de Toulouse-Lautrec (1864-1901)



Courtesy Museum of Modern Art, N. Y.

AMERICAN POSTER, 1917

By Howard Chandler Christy



Courtesy Museum of Modern Art, N. Y.

FRENCH POSTER, 1934

By A. Mouron Cassandre



Courtesy Museum of Modern Art, N. Y.

RUSSIAN POSTER, 1930

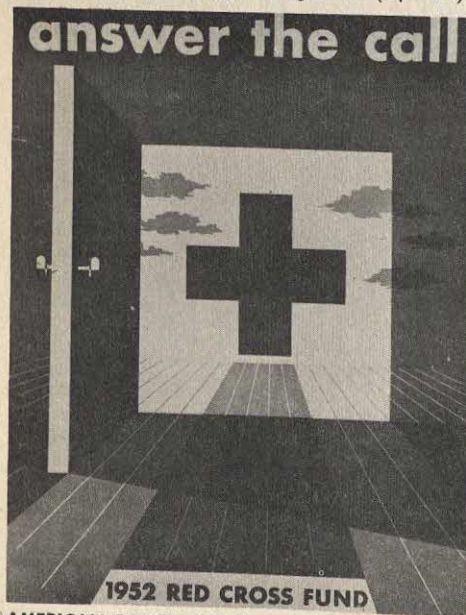
Fulfilled Plan—Great Work, by G. Klutizis



Courtesy Museum of Modern Art, N. Y.
and Chinese News Service

CHINESE POSTER, 1937

Potash (pōt'āsh). See *Potassium*.
Potassium (pō-tās'sī-ŭm), a metallic element with an atomic weight of 39.096; its atomic number is 19 and its symbol K; its specific gravity is 0.96 and its melting point 63.6° C. (146° F.).



AMERICAN POSTER, 1952

By Joseph Binder, New York City

Potassium was first prepared in 1807 by Sir Humphry Davy by electrolyzing potassium carbonate (potash). It is a very reactive metal, burns readily in air, and reacts with water, forming potassium hydroxide, and releasing hydrogen, which catches fire. In the laboratory, potassium must be stored under petroleum naphtha, to keep it from being oxidized by the air.

Metallic potassium has very little commercial importance, but its salts are indispensable as fertilizers. Potassium chloride and some other salts of potassium are found in Germany and France, and for use in the U.S. potassium salts are mined at Carlsbad, N.M., and smaller quantities are obtained as a by-product of borax manufactured from the brines of Searles Lake, California.

Potassium salts (often referred to as "potash") are made up into fertilizers called "mixed goods," and described by three numbers, such as 5-10-10, which refer to the percentages of the three essential ingredients, 5% N (nitrogen, in the form of compounds), 10% P₂O₅ (phosphoric acid, as phosphates), and 10% K₂O (equivalent K₂O, or "potash," content of potassium salts).

The word potash should refer strictly to potassium carbonate or potassium hydroxide, but it is also used to express the equivalent K₂O (potassium oxide) of any potassium salt.

Potato (*pô-tā'tō*), one of the most valuable food-producing plants. It is cultivated extensively throughout the Temperate Zone. The potato is native to the Andean region of South America, where it was cultivated by the Incas long before the discovery of America. Much uncertainty is attached to the early history of the potato in Europe and North America. It is not unlikely that Spanish sailors, on their return from Peru, brought back the first potatoes to Spain and Portugal. From Spain the potato was probably brought to Italy before the middle of the 16th century. Early in the following century, the potato spread to Austria, Germany, Switzerland, and France. According to one legend, Sir Francis Drake (*q.v.*) introduced the potato into Ireland around 1586. Another legend attributes the introduction of the potato to Sir Walter Raleigh (*q.v.*), who is supposed to have brought the plant from Quito, Ecuador, to Ireland. It is believed that potatoes were first planted in North America at Londonderry, N.H., in 1719. By the close of the 18th century, its cultivation and use had spread over most of Europe and many countries of Asia. It is now a staple article of food among all classes, but because of its low cost and high food value, it has assumed a prominent place in the daily diet. The growth in popularity of the potato in the comparatively short period since it was first introduced into Europe may be seen from the output of potatoes in recent years. Excluding the U.S.S.R. and China, for which there are no figures available, the annual average total potato crop for the world exceeded 214,500,000 short tons in 1957.

The potato belongs to the same family as the nightshade, tobacco, and henbane. It is an annual plant with large, herbaceous stems, growing from 1 to 3 ft. in height. The leaves are pinnate and the flowers are of a whitish, bluish, violet, or variegated color. Some species bear a globular fruit somewhat larger than a gooseberry, which contains a number of small seeds. The tubers are the valuable part of the plant and grow underground on slender leafless shoots or branches that differ in character from the true roots. The different species of potatoes vary in form, size, color, quality, and time of ripening, and their size has been greatly increased by cultivation. The value of the tuber depends upon the starch and other food constituents stored in it. These are usually about 20% of starch, 1% of ash, 3% of sugar, gum, albumen, casein, gluten, and kindred substances, and about 76% of water. Each potato has a number of eyes, or leaf buds, and propagation is effected usually by planting pieces of the tubers, each piece containing one or more eyes.

Early species of potatoes mature in about three months, but the tubers may be utilized for food under favorable conditions in about six weeks

after planting. Some varieties require a longer growing period, depending upon the soil and climate. The yield is from 25 to 300 bu. per acre, depending upon conditions of soil and climate. Irrigated farms in the U.S. produce an average yield of about 220 bu. per acre, non-irrigated lands about 75. In world production, Russia was long the leading country, with Germany, Poland, France, and the U.S. following in that order. Total U.S. potato production and prices received by farmers have fluctuated over the past 30 years. Production has ranged between ca. 200,000,000 cwt. and 260,000,000 cwt. per year, while the average price received by farmers in 1958, estimated at \$1.28 per cwt., was only slightly higher than the 1936-40 average price of \$1.14 and much lower than the 1952 peak price of \$3.25. In the meantime, yield per acre rose markedly, from ca. 65 cwt. in 1931-35 to 180 cwt. in 1958. Of the many hundred varieties, the most cultivated are Irish Cobbler, Triumph, Green Moun-



HARVESTING POTATOES

tain, Russet Burbank, Russet Rural, Katahdin, Chippewa, White Rose, Sebago, and Red McLure.

Potato, SWEET, a climbing perennial plant cultivated extensively for its tuberous root, which is a wholesome and favorite article of food. The leaves are either cordate or lobed and are borne on slender, twining stems. The roots are large, with somewhat pointed ends, and of a reddish or yellowish color, and grow in clusters at a small depth below the surface. Sweet potatoes are propagated by setting the tubers out in the spring, and the rows are ridged in midsummer to facilitate the development of the tuber-roots. The original home of the sweet potato is not known, but it is thought to be of tropical origin. Its culture is comparatively modern, but it was culti-



Courtesy West Virginia Industry & Development Com.
VIEW OF THE POTOMAC RIVER VALLEY

vated earlier than the common potato, or *Irish potato*, as a food plant. It is grown in North America as far north as southern Canada. The yield is best in a rich, sandy loam. The yam (*q.v.*) somewhat resembles the sweet potato.

Potato Beetle (*bē'tl*), **POTATO BUG**, or **COLORADO POTATO BEETLE**, a small beetle (*Leptinotarsa decemlineata*) which feeds destructively on the leaves of the potato, eggplant, tomato, and other plants used as vegetables. First noticed in Colorado about 1820, it infested almost all of North America and Europe. Adult beetles are about $\frac{3}{8}$ in. long, hemispherical, yellowish orange, with ten black stripes (whence *decemlineata*) on the hard wing covers over the back. The larvae are soft-bodied, humpbacked, reddish orange, with two rows of black spots along each side. Spraying or dusting leaves with lead or calcium arsenate is a recommended control measure.

Potato Chips (*chips*), extremely thin slices of potato, fried crisp in deep fat.

Potato Fly (*flī*), or **ROOT MAGGOT**, the larval form of a true fly (*Hylemyia cilicrura*), the adult of which resembles the common housefly. The maggots eat a wide variety of vegetable matter but prefer sprouting or damaged potatoes. A new generation may appear every three weeks.

Potato Worm (*wūrm*), the caterpillar of a small, dark, speckled moth (*Gnorimoschema operculella*) of worldwide distribution, especially in warmer regions. When small it burrows in leaves of potato and tomato plants but later enters fruits and tubers.

Pot-au-feu (*pō-tō-fū*), French, meaning pot on the fire, a stewlike dish consisting of meat, vegetables, and broth boiled together in a pot.

Potemkin (*pō-tēm'kin*), **GRIGORI ALEKSANDROVICH**, statesman, famous as a conspirator, born near Smolensk, Russia, in 1739; died Oct. 5, 1791. He began his career as an officer in the Horse Guards, and was prominent in the plot which

POTOSÍ

ousted Peter III in 1762. He fought in the Russo-Turkish War (1769), and was rewarded with the favor of Catherine II, who made him field marshal in 1784. Instrumental in shaping Russia's European policies, he annexed the Crimea (1783), originated Russia's Black Sea fleet, and built the arsenals of Kherson and Sevastopol. During the second war against Turkey, in which he was commander in chief of Russian forces (1787-91), Catherine made him Prince of Tauris. However, much of his effectiveness in administration was due to an unscrupulous use of display without foundation in fact, a good example being his famous construction of false-front villages in 1787, to impress Catherine II with the success of his Crimean administration.

Potidaea (*pōt-i-dē'ā*), an ancient city of Macedonia, situated on the isthmus between the Pallene peninsula and the Chalcidice district of Greek Macedonia. Founded in about 609 B.C., the city revolted from Athenian control in 432 B.C. and became one of the causes of the Second Peloponnesian War. It was later captured by the Athenians in 429 B.C., and (356 B.C.) by Philip of Macedon, who destroyed the city. It was rebuilt in 301 B.C. by Cassander, and named Cassandreia. Still inhabited, it has a population of about 1,000.

Potiphar (*pōt'i-fār*), in the Old Testament, the officer of Pharaoh to whom, according to Genesis 37:36, Joseph (*q.v.*) was sold. The wife of Potiphar tried in vain to seduce Joseph with her charms.

Potomac (*pō-tō-māk*), a river of the Middle Atlantic states, which rises by two branches in the Allegheny Mts., in West Virginia, and after flowing some 400 m. enters Chesapeake Bay by an estuary. It forms the boundary between West Virginia and Maryland and between Virginia and Maryland. The course to Cumberland, Md., is northeasterly; but east of Cumberland it makes a bold turn toward the southeast, passing Harper's Ferry, Washington, and Alexandria. The estuary is 100 m. long and about 8 m. wide at its entrance into Chesapeake Bay. Tidewater reaches Washington, a distance of 125 m. from its mouth, and it is navigable for much of its course. Above Washington are several falls and rapids, which obstruct navigation.

Potosí (*pō-tō-sē'*), a city of Bolivia, on the slope of Cerro de Potosí, about 50 m. s.w. of Sucre. The mountain has an elevation of 15,200 ft., and the city is situated on a sloping plain 13,250 ft. above sea level. It was founded in 1545 in the midst of a productive gold and silver mining region and in 1611 had a population of 165,000. It is the seat of a university. More recently the mines have failed rapidly, chiefly because of a marked decrease in the value of silver, and much of the former city is desolate and in ruins. The surrounding country is unproductive aside

from its extensive mineral deposits, especially bismuth, and grazing lands. Mt. Cerro de Potosí is covered with snow perpetually, thus greatly modifying the climate, but there is an abundance of water for mining purposes. Population, *ca.* 40,000.

Potpourri (*pō-pō-rē'*), a term derived from the French, variously applied to indicate a medley or hotchpotch. It is the name of a mixture of dried, sweet-smelling flower petals used to perfume a room, which is placed in a vase covered with a perforated lid. The flowers used chiefly are violets, roses, and jasmines, but they are mixed with lavender, cloves, sandalwood, and musk. The term is used also to signify a kind of incense made of mixed gums and seeds, to describe a medley of musical airs, and to signify a literary production of parts brought together without a bond of connection. A mixture of meats and vegetables, such as a stew or potpie, is sometimes called potpourri.

Potsdam (*pōts'dām*), a city of Germany, 16 m. s.w. of Berlin. It was the second royal residence of Prussia and Germany. It is situated on the Havel River and is connected with Berlin by trolley lines and railways. In the vicinity are a number of beautiful lakes and ranges of hills covered with forest trees. The surrounding country has a fertile soil, producing cereals, fruits, and tobacco. Among the noted buildings are the royal palaces, of which *Sans Souci*, erected by Frederick II in 1745, is the most noteworthy, and numerous churches. The Garrison Church has a tower 400 ft. high, and under its pulpit are the remains of Frederick William I and Frederick II. It has several beautiful public gardens and boulevards, a public library, and several historic statues and monuments. Potsdam's manufactures are diverse. It was a fishing village until 1660, when Frederick William I made it a royal residence. The "Big Three" (the leaders of the U.S., Great Britain, and the U.S.S.R.) held a conference here in the summer of 1945, issuing the *Declaration of Potsdam*, demanding unconditional surrender from Japan (*q.v.*). Population, *ca.* 80,000. See also *Berlin*.

Potstone (*pōt'stōn*), an impure variety of soapstone, composed of a mixture of mica, talc, and chlorite. Though soft when quarried, it becomes hardened by exposure to air, and is used to some extent in making household utensils. In ancient times it was used chiefly for that purpose and its utility appears to have been widely known, since it is mentioned by Pliny and other ancient writers. Extensive deposits are found in Greenland, Austria, the Scandinavian Peninsula, and upper Egypt.

Pottawatamies (*pōt-a-wōt'a-mīz*) or POTA-WATAMI, a North American Indian tribe of the western Alonquian-speaking group. It early

occupied the region now included in lower Michigan and upper Indiana and Illinois. The French established missions among these Indians at Green Bay, but they afterward joined Pontiac. They were hostile to the Americans during the Revolution, but concluded a peace treaty in 1795. In 1812 they again aided the English, but in 1815 ceded nearly all their territory, when many were assigned land in Missouri and Kansas. At present the tribe numbers about 1,750.

Potter (*pōt'ēr*), PAUL, painter, born at Enkhuysen, Holland, in 1625; died in Amsterdam, Jan. 15, 1654. His father, Pieter Potter, was a landscape painter, and under his direction he received early training in Amsterdam, at the same time making an intensive study of nature. He executed a number of famous paintings before he was 15, and in 1650 settled at The Hague. In 1652 he returned to Amsterdam, engaged by the burgomaster to execute many important paintings. Constant work at the easel damaged his health, and he died at the early age of 29.

Potter was outstanding as an animal painter; horses and cattle alike aroused his interest, and he rendered them with careful observation as though they were individual portraits of animals. His landscape background is fresh and direct in approach, all in clear and transparent colors, with a profusion of sunny light in most cases. He was, at his best in his smaller paintings and in his etchings.

Potter's Field (*pōt'ēr'z fēld*), as mentioned in the New Testament (Matthew 27:7) "to bury strangers in," has become the popular name of public burial places for those who have no one to provide for their burial.

Pottery (*pōt'ēr-y*), the art of manufacturing earthenware or porcelain by modeling any kind of clay when in a plastic condition and then hardening by fire. It is known as ceramic art (*q.v.*), or ceramics, especially when it relates to making vessels and utensils.

HISTORICAL. This art was practiced from remote antiquity, the remains and monuments of many races giving it a standing among the industries pursued in prehistoric times. Both glazed brick and tiles have been found among the ruins of ancient Nineveh, and on the monuments of Thebes are views of potters at work, showing that earthenware entered prominently into household and public uses many centuries before the Christian era. The Mosaic writings make mention of earthenware. In the Metropolitan Museum of Art, in New York, are fine specimens of pottery, including jars, vases, cups, lamps, and household utensils, brought by Gen. di Cesnola from Cyprus, where they were made by the ancient Phoenicians. It is thought that the Greeks learned the art of making pottery from the Egyptians and the Phoenicians, and that the Romans learned



Courtesy Metropolitan Museum of Art, N. Y.

GREEK VASE, 550-530 B.C.

it from the Greeks. Extensive potteries were maintained at Athens, Samos, and Corinth, where most of the pottery of Grecian manufacture was made. The product from these potteries was of splendid design and ornamentation, specimens extant possessing remarkable perfection. Many of the vases now made are patterned after the finest Grecian products. See also *Terra Cotta; Vase Painting*.

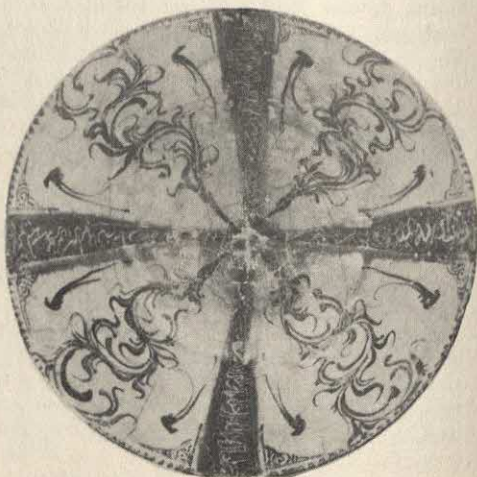
The art was carried to Spain by the Arabs, who have credit for introducing the manufacture of glazed ware into Western Europe. Although the art of making this grade of ceramics was long thought to be of relatively modern origin, excavations in the ruins of Babylon in the last century disproved this view, since many glazed products were found there, including glazed coffins, vases, and household utensils. The Arabs were the first to make the famous *majolica ware* on the island of Majorca (see *Faience; Majolica*). In the 14th century the art was introduced into Florence and several other Italian cities, whence the French learned it, but some essentials remained secret until Bernard Palissy (ca. 1510-89), a French potter, discovered the important features involved in making majolica and subsequently added many valuable improvements such as ornamenting the ware with pictures.

Artistic pottery was introduced into Germany, Gaul, and Britain by the Romans, who made products from native clays, but rude wares had been made in these regions for centuries before. The Dutch developed a peculiar kind of pottery,

known as *delft* from its extensive manufacture at Delft, Holland. Delft wares are more solid and less beautiful than those produced by Eastern methods, but they became noted for their remarkable strength. The manufacture of pottery on a large scale in the U.S. is of comparatively recent date. However, there has been a constant growth in the annual domestic output. Production of pottery is a major industry in Los Angeles, Calif.; Steubenville, Ohio; Syracuse, N.Y.; and particularly in Trenton, N.J.

PORCELAIN. The manufacture of porcelain has been an important industry among the Chinese and Japanese from a period antedating the Christian era. They were making the finest grade of porcelain while the Greeks were still using terracotta vases, and their skill in the finer ceramic art dates fully 2,000 years earlier than that of the Europeans. King Teh-chin in the province of Kiangsi was for centuries the center of vast potteries, and it is known that excellent grades of porcelain were made there in the 6th century A.D. Many thousand porcelain furnaces were in use in that city in the 18th century, but the Taiping insurrection destroyed practically all the works. The varieties of Chinese porcelain are endless in form and decoration and comprise some of the most delicate and beautiful known.

The clay used in making porcelain is kaolin (q.v.); it was thought to exist only in China, but J. F. Böttger (q.v.) discovered (ca. 1700) deposits of it near Dresden, Saxony. He learned the secret of making porcelain while employed by the Elector of Saxony and a factory was established at Meissen, near Dresden, where the well-known Dresden porcelain is still made. In 1720, a workman carried the secret to Vienna, which became a noted center of porcelain manu-



Courtesy Metropolitan Museum of Art, N. Y.

PERSIAN BOWL, 13th CENTURY

POTTERY

facture, and these two cities are still among the most extensive producers of these products in Europe. See *Chinaware*.

MANUFACTURE. Many kinds of pottery are made, but all varieties are produced by molding the clay while in a moist condition into the forms desired, after which they are baked in an open fire. The molded forms are ornamented with patterns stamped into the clay before firing, but some of the grades are plain. Manufacturers mix various matters with the clays to make finer and more delicate pottery, or decorate it by paintings. Pottery is said to be *soft* when its surface is unglazed and easily scratched by a piece of iron, and *hard*, when the iron has no effect on it. A common flowerpot belongs to the soft earthenware and a Sèvres plate to the hard variety. Between these two grades are many kinds of wares. Pottery is generally divided into earthenware, stoneware, and china or porcelain. *Earthenware* is soft and includes many varieties of products, but principally *unglazed ware*, as brick, terra cotta, and flowerpots; *lustrous ware*, or products baked and coated with a slight vitreous glaze, as the ancient Greek vases; *glazed ware*, embracing ordinary clay ware with a lead glaze, as common household ware; and *enameled wares*, including ordinary clay ware with an opaque glaze, as Italian majolica or Dutch delft. *Stoneware* is a kind of pottery characterized by hardness and infusibility, properties due to the silica in the clay forming the body. The two principal varieties are a kind which is generally colored or dark and usually coated with a salt glaze, as a stoneware crock; and a kind which is light in color and coated with a vitreous glaze containing lead, as granite ware.

Porcelain is the finest and most valuable grade of pottery and is characterized chiefly by hard-



Courtesy Metropolitan Museum of Art, N. Y.

FAIENCE PLATTER, 1710-1720

ness. It is almost infusible, is somewhat translucent, and usually has an alkaline glaze. It is made of a body of clay containing silica, usually called *kaolin*. The principal classes include the *hard porcelain*, made of a body of kaolin and feldspar, as the porcelain known as Chinese, Berlin, and Sèvres; the *soft porcelain*, made of kaolin and calcium phosphate coated with a lead and boric acid glaze, as Worcester porcelain; and *artificial porcelain*, a kind resembling glass and made chiefly of alkaline salt and coated with a lead glaze, as the porcelain formerly made at Sèvres, France.

METHODS. Pottery is made by the workman molding and turning the plastic clay on his wheel, a kind of turning lathe, and it is then taken to a room and partially dried under a high temperature. After drying to what is called the *green state*, the product is again placed on the lathe for the purpose of giving it a truer shape and smoothness. However, this depends largely on the form of the articles, since the more complicated circular form must be pressed into molds of plaster of Paris and the work is done almost exclusively by hand. Practically the only machines used in making pottery are the mechanism for mixing clay and the turning wheel of the workman. The articles are ready for the kiln as soon as they are properly shaped and dried, and they are exposed to a high temperature about 40 hours. It is necessary for the kiln to cool very slowly, since rapid cooling causes the articles to warp or crack. They are glazed by immersing in a vitrified composition and subjecting to heat a second time. Decorations are put on in various ways, in some cases by press printing and in others by hand. Paintings are put on earthenware with a brush, usually over the glaze (see also *Glazing*).

Pottstown (pōt's'toun), a borough of Montgomery County, Pennsylvania, on the Schuylkill



Courtesy Metropolitan Museum of Art, N. Y.

MAJOLICA PLATE, ABOUT 1515-1525

River, 38 m. n.w. of Philadelphia, on the Pennsylvania and the Reading R.R.'s. It is surrounded by an agricultural and mining district and is the center of large manufacturing enterprises, which include plastics, tires and tubes, fabricated steel, die castings, and machine products. Nearby is the Hopewell Village National Historic Site. Pottstown was laid out in 1752, when it was named Pottsgrove, and it was incorporated under its present name in 1815. Population, 1900, 13,696; in 1940, 20,194; in 1950, 22,589.

Pottsville (*pōts'vil*), county seat of Schuylkill County, Pennsylvania, on the Schuylkill River, 35 m. n. of Reading. It is on the Lehigh Valley, Pennsylvania, and Reading R.R.'s. The major industry is anthracite coal mining. The Molly Maguires, a lawless secret society of miners, met here until the organization was broken in 1877. The Schuylkill Undergraduate Center of Pennsylvania State Coll. is located here. Among the manufacturing plants are railroad car repair shops, paper box factories, knitting mills, machine shops, foundries, and shirt factories. First settled in 1780, Pottsville was laid out in 1818 and incorporated in 1828. Population, 1900, 15,710; 1950, 23,640.

Poughkeepsie (*pō-kēp'sī*), county seat of Dutchess County, in southeastern New York, on the Hudson River, 75 m. n. of New York, N.Y. The city covers an area of 4.78 sq. m. and is 200 ft. above sea level. It is served by the New York, New Haven and Hartford, and the New York Central R.R.'s. At Poughkeepsie, the river is crossed by a cantilever railroad bridge and the long suspension Mid-Hudson Highway Bridge. Poughkeepsie has a large commercial trade and many industries. The manufactures include bags and baskets, business machines, chemicals, clothing, cough drops, cream separators and milking machines, electronic devices, elevators, printing, and metal goods.

The Hudson River State Hospital for the Insane is situated here, as is Vassar Coll. (*q.v.*), a women's college. Landmarks include the Glebe House (1767), the oldest house in Poughkeepsie, and Governor Clinton House (1783), now a state museum.

Poughkeepsie was settled by the Dutch in 1687. It was the seat of the New York State legislature in 1778-95, was chartered as a village in 1799, and incorporated as a city in 1854. The name is derived from the Indian words "*Uppuqui ipis ing*," meaning "the reed-covered lodge by the little water place." Population, 1950, 41,023.

Poulsen (*poul'sen*), VALDEMAR, inventor and engineer, born Nov. 23, 1869, at Copenhagen, Denmark; died Aug. 6, 1942. He studied science at the Univ. of Copenhagen but left before graduating to become assistant engineer with the Co-

penhagen Telephone Co., where his specialty was radio telegraphy. In 1898 he invented the telegraphone, a device which made it possible to record speech electromagnetically on a steel wire. He then retired from the telephone company to conduct his own research and in 1903 he discovered the so-called Poulsen arc, which made possible the development of voice radio, although later a more efficient radio wave generator was invented.

Poultry (*pōl'trī*), the term applied generally or collectively to domestic fowls. They are reared for their flesh, eggs, or feathers, as chickens, geese, turkeys, ducks, guineas, and pigeons. The common chickens are the most important of the domesticated birds, since both their flesh and eggs are wholesome and favorite food. Such naturalists as Darwin ascribed the origin of the domesticated breeds of chickens to the Bankiva fowl. We learn from history and ancient paintings that poultry culture is of great antiquity, both civilized and savage peoples engaging more or less successfully in rearing different classes of birds. By far the largest amount of poultry reared is bred by farmers and others who make its culture a profitable adjunct to other enterprises, but in some localities special poultry farms are maintained. In many parts of the world poultry keeping is the leading pursuit of the peasant, and in many places extensive yards may be seen for the confinement of chickens, while in others herders are employed to watch over vast flocks of geese and ducks. The total annual production of poultry and eggs in the U.S. had a gross value in 1945 of about \$3,000,000,000. The eggs of chickens comprise the most important poultry product sold in the market, but the eggs of geese, ducks, and guineas are marketed to a limited extent. As a rule, chickens and turkeys are reared for their flesh and eggs; geese and ducks, for their flesh and feathers; pigeons, for their flesh; and guineas, for their flesh and eggs, or for ornament in the barnyard.

In propagating poultry it is necessary to take into account the objects desired, especially in chickens, since the varieties best adapted for flesh are as a rule inclined to lay only a limited number of eggs, while the prolific layers are often poorly fleshed. For mixed farming it is usually desirable that the size be medium, combining both flesh and egg-producing qualities. It is necessary to provide clean and well-ventilated houses provided with ample sunlight.

Small flocks of poultry may be fed kitchen and garden wastes supplemented by commercial feeds. The farm chicken flock allowed to range widely will secure as much as one-fifth of its feed from grasses, legumes, weed seeds, insects, and waste grains and other materials in the barnyard. Simple diets consisting of home grown grains and

skim-milk supplemented with oil meals, packing house byproducts and limestone are adequate for such flocks.

Confined flocks and large flocks with limited range require carefully formulated supplements, in addition to grain, containing adequate amounts of vitamins, proteins, and minerals. These supplements usually contain dehydrated alfalfa, soybean oil meal, meat meal, fish meal, mill feeds, salt, limestone, manganese, distillery byproducts, and other vitamin-rich feedstuffs in proportions known to supply the nutritive requirements of the various classes of poultry.

Geese can obtain most of their food during the growing season from pasture.

Ducks spend much time in bathing and searching for food at the bottom of shallow water.

The eggs of chickens require three weeks for incubation, while those of turkeys, geese, and ducks require four weeks. Machines have been constructed for artificial incubation, the warmth necessary being provided by lamps or by an electric current. Many advantages result from the use of incubators, particularly the benefits derived from the ability to secure broods at any season of the year, and to obtain any number of young at a brood.

Pound (*pound*), a unit of weight; which is used as a standard in several countries for the measurement of any commodity bought and sold by weight. However, the denominations differ somewhat. The pound *troy* is equal to 12, and the pound *avoirdupois* to 16 ounces. The pound *troy* has 5,760 grains, the standard being obtained by weighing a cubic inch of distilled water at 62° F., the barometer being 30 in., which then weighs 352.458 grains *troy*. The *avoirdupois* pound is equal to 7,000 *troy* grains; hence the *troy* pound is to the *avoirdupois* as 144 to 175.

The pound is of English origin and was derived from the weight of 7,680 grains of wheat taken from the middle of the ears and well dried, for which reason *grains* form the lowest fractional part of a pound. This continued to be the standard pound from William the Conqueror to Henry VIII, but in the reign of the latter the *avoirdupois* pound of 7,000 grains came into use. Since the time of Elizabeth it has been the standard in England, whence it was brought to America and is now used in Canada and the U.S. The principal English coin of account is called *pound*, or *pound sterling*, and corresponds to the coin of circulation known as *sovereign*. It is divided into 20 *shillings*, or 240 *pence*, and weighs 123.27+ *troy* grains. The name was derived from the fact that one pound of silver was formerly coined into 240 silver pence, but now 40 pounds of gold are coined into 1,869 *sovereigns*. The sign of the pound is £. See also *Coin*.

Pound, SIR ALFRED DUDLEY PICKMAN ROGERS,

naval officer, born Aug. 29, 1877; died Oct. 21, 1943. Entering the British naval service in his youth, Sir Dudley Pound participated in the Battle of Jutland (1916) as commander of the *Colossus*, becoming one of the heroes of World War I. He was made admiral of the fleet in 1939. Commander in chief of naval operations in the Mediterranean (1936-39), he was first sea lord and chief of naval staff when he died.

Pound, EZRA LOOMIS, poet, literary critic, born in Hailey, Ida., Oct. 30, 1885. He was educated at Hamilton Coll. and the Univ. of Pennsylvania. A pre-World War I expatriate, Pound lived in London (1908-20) and Paris (1920-24) before settling in Rapallo, Italy, where he stayed until captured by the Allies after World War II. Brought to the U.S. to stand trial on treason charges arising from his anti-American radio broadcasts from Italy, he was judged insane and confined to a hospital (1946-58). Released, the charges dismissed, he returned to Italy.

Always a controversial figure, Pound was, nevertheless, recognized as a major literary figure in the interwar period. He exercised considerable influence on such authors as T. S. Eliot and Ernest Hemingway. He was a leading Imagist (*q.v.*) and important in later poetry movements. His own work was varied, ranging from translations of the poetry of the troubadours and of Chinese and Japanese plays and poems to minor tracts on economics. His poetry included "Ripostes" (1912), "Lustra" (1916), and "Personae" (1926), the last a reprint of two earlier volumes. His many prose works included "Culture" (1938) and "Confucian Analects" (1951). Most noted, however, particularly for their experiments in verse form, were his "Cantos," the earliest of them published in 1919. By 1955, 93 of a planned 100 cantos had been published; the completed work was to be similar to Dante's "Divine Comedy" in structure. For the 1948 "Pisan Cantos," Pound received the Bollingen Prize for Poetry, which caused much discussion.

Poundal (*poun'dal*). See *Force*.

Pour le Mérite (*pōor lē mā-rē'*), French expression meaning "for merit." It was the name chosen for an order founded by Frederick the Great (1712-86) of Prussia, and continued until 1919. It was later revived in Hitler Germany.

Poussin (*pōo-sān'*), NICOLAS, painter, born at Villers, France, in 1594; died Nov. 19, 1665. He went to Paris in 1612 to study painting. Later he studied at Rome, where he developed, together with Claude Lorrain (*q.v.*), a distinct style of historical and landscape painting, the so-called "heroic" landscape. Nature, with ruins reminiscent of antiquity, was the background for lively mythological scenes. He traveled and painted in France, but at the age of 30 decided to leave France permanently, and settled in Rome. After



NICOLAS POUSSIN

severe financial struggles, he came in contact with Cardinal Barberini, who gave him many orders for pictures. While in Rome he painted "The Capture of Jerusalem" and "The Death of Germanicus." This patronage brought him good fortune. He was not only commissioned by Cardinal Richelieu, but he did some work in Paris for the king himself. His paintings are owned by many famous museums and some of them have become well known through engravings done from them.

Powderly (*pou'dēr-lī*), TERENCE VINCENT, labor organizer, born in Carbondale, Pa., Jan. 22, 1849; died June 24, 1924. He became a switchman on the Delaware & Hudson R.R. at the age of 12 and engaged as a laborer in the machine shops at Scranton when 19. He was elected as a labor candidate to the office of mayor of that city in 1877 and was re-elected in 1878. In 1879 he became general master workman of the Knights of Labor, a position he held until 1893, when he was succeeded by James R. Sovereign. President McKinley appointed him commissioner general of immigration in 1897. Powderly wrote several treatises on the labor question and contributed extensively to the *Arena* and the *North American Review*.

Powell (*pou'ēl*), JOHN WESLEY, geologist, born in Mt. Morris, N.Y., Mar. 24, 1834; died Sept. 23, 1902. He studied at Oberlin Coll. and entered the Federal service at the beginning of the Civil War. For valued service he was promoted to the rank of lieutenant colonel and at the Battle of Shiloh lost his right arm. In 1865 he became professor of geology in the Iowa Wesleyan Univ. and later in the Illinois Normal Univ., at Bloomington, Ill. He was engaged by the Smithsonian Institution, in 1867, to conduct geographical and geological surveys in the Rocky Mt. region and later explored the Grand Canyon of the Colorado River. He later became director of the Bureau of

POWERS

Ethnology, which was established by the government, and in 1881 succeeded Clarence King as director of the U.S. survey. He resigned the latter position in 1894 owing to delicate health, but retained the directorship of the Bureau of Ethnology. His writings include: "Report on the Arid Region of the U.S.," "Contributions to North American Ethnology," and "Introduction to the Study of Indian Languages."

Powell, THOMAS REED, lawyer and educator, born in Richford, Vt., April 29, 1880; died in Boston, Mass., Aug. 16, 1955. After he was graduated from the Univ. of Vermont, he took his law degree at Harvard Univ. in 1904 and in the same year was admitted to the bar. A lecturer and teacher at several institutions, he taught at Columbia Univ. (1910-25) and then at Harvard Law School, becoming professor emeritus in 1949. He was a contributor to scholarly magazines and, among other books, published "Separation of Powers" (1913).

Power (*pou'ēr*), in mathematics, the number of times a factor is multiplied by itself. Thus, the second power of 2 is $2 \times 2 = 4$; the third power, $2 \times 2 \times 2 = 8$. The former is the square and the latter is the cube of 2. The degree of the power, or the number of times the given quantity is taken as a factor, is expressed by a number called the *exponent*, which is written above and at the right of the quantity. *Involution* is the process of finding the power of a number.

Power of Attorney (*pou'ēr of ā-tūr'nī*), a written instrument in which the signer authorizes another to act for him as agent or attorney. Such instruments are either *special* or *general*; the former limits the holder to a certain act or acts, while the latter confers authority without limitation.

Power, TRANSMISSION OF. See *Dam*; *Electricity*; *Hydraulics*.

Powers (*pou'ērz*), HIRAM, sculptor, born in Woodstock, Vt., July 29, 1805; died June 27, 1873. He went to Washington in 1834, where he was engaged to execute busts of the President and several prominent persons. His success enabled him to go to Florence, Italy, in 1837, where he devoted the remainder of his life to art. He is noted chiefly for his excellent busts of American statesmen. His statue of "Eve," completed in 1838, was admired by Thorwaldsen, and the following year he attained a world-wide reputation by his celebrated "Greek Slave." Other works of renown include: "The Fisher Boy," "The Last of His Tribe," "Proserpine," and "America."

Powers, THE GREAT, the name employed in modern diplomacy to designate the most powerful nations. In general the term is applied to those nations possessing great military and political strength, and therefore capable of pursuing diplomatically independent roles. At the outbreak

of World War II, the great powers included the U.S., Great Britain, the Soviet Union, France, China, Germany, Italy, and Japan. As a result of the defeat of Germany, Italy, and Japan, these nations have lost much of their prewar stature. See *Axis Powers*; *Entente*; *Entente Cordiale*.

Powhatan (*pou-hà-tân'*), chief of the Powhatan Confederacy, born about 1550; died in 1618. His real name was Wahunsonacock, but he was called Powhatan from the name of his tribe. He was a man of much native talent and through military successes he became the sachem of 30 tribes, which numbered about 8,000 persons. The region occupied by these tribes extended from the James to the Patuxent Rivers. John Smith visited him in 1609, and he accepted a gilded crown brought from Europe. Later he began to look upon the advent of the white man with displeasure and prepared to attack the English by night, but was foiled by the watchfulness of his daughter, Pocahontas. At one time he held Smith as a prisoner and condemned him to death, but through the plea of the chief's daughter his life was spared. He continued hostile to the English until the marriage of Pocahontas with Rolfe, when he became their firm friend.

Poynter (*point'ēr*), SIR EDWARD JOHN, British artist, born in Paris, France, Mar. 20, 1836; died July 26, 1919. He studied at Westminster School and Brighton Coll. and while in Madeira for his health, in the winter of 1852-53, developed a taste for painting. The following year he studied at Rome and in 1856 at Paris. His first exhibits at the British Institution were made in 1859 and in 1869 he became an associate of the Academy. During the interim he devoted much time to the study of Egyptian art and prepared illustrations for *Once a Week* and for Dalziel's "Illustrated Bible." He became professor of art in the London Univ. Coll. in 1871 and was made a full academican in 1876. In 1896 he succeeded Frederick Leighton as president of the Royal Acad. and was knighted.

Poznań (*póz'nän-y*), capital city of Poznań, province of Poland since 1919. Situated on a broad, sandy plain through which the Warta River flows, the city lies 180 m. w. of Warsaw, 150 m. E. of Berlin. Half German, half Polish in population before World War I, its German citizens largely returned to Germany after the establishment of the Polish republic. Before World War II, the German population constituted about five per cent. Railroads radiating from Poznań connect the city with Warsaw, Berlin, Breslau, and Torun. The seat of the oldest Polish bishopric, which was founded in the 10th century, Poznań contains 15 Roman Catholic churches, as well as the tombs of the first two rulers of Poland, the large Raczynski and Wielkopolska libraries, two museums and the Univ. of Poznań. The agricul-

tural products of the province are brought to Poznań for such processing as distilling, brewing and sugar milling. Farming machinery is manufactured, and an assembling plant for locomotives has been established. Trade is brisk, by rail and water, in corn, cattle, wool, wood, and potatoes. One of the oldest Polish cities, Poznań was the residence of the first Polish king, Boleslaw the Brave. Damaged by fire in 1536 and 1590, Poznań was rebuilt in Renaissance style. It was occupied by the Germans during World War II. Population, ca. 270,000.

Pozzuoli (*põt-sõ-õ'lë*), a city of Italy, anciently called Puteoli, situated on the Bay of Naples, about 7 m. w. of Naples. It is of interest because of its ancient importance, when it contained the Temple of Augustus and an amphitheater with a seating capacity of 30,000 persons. The temple has been converted into a cathedral and the amphitheater, famous because of its gladiatorial fights under Nero, is in ruins and partly submerged in the sea. Among the other buildings of historic interest is the Temple of Serapis, an Egyptian god. This structure had a portico of 24 pillars, 13 of which remain. It had several other temples of interest, the harbor of Puteoli, and numerous baths and tombs. Hannibal made an unsuccessful assault upon the city in 214 B.C., and toward the latter part of the republic it was the principal port of Rome. A railway connects Pozzuoli with Naples. Population, ca. 24,000.

Prado (*prã'dõ*), Spanish National Museum, located at Madrid, and one of the most famous in Europe. The palace, which houses paintings by such masters as Titian, Tintoretto, Velasquez, and Goya, and famous sculptures of all periods, was begun in the second half of the 18th century as a museum of natural history. In its present form it was completed in the early 19th century.

Praetor (*prẽ'tór*), the official title of the consuls at Rome. In 367 B.C., the consulship was thrown open to the plebeians, and the patricians stipulated that a patrician magistrate should be appointed to act as supreme judge in the civil courts. His official title was *praetor*. The praetorship was opened to the plebeians in 336 B.C. Because of the large number of foreigners residing in Rome, it was found advisable to appoint a second praetor about 245 B.C., whose duty was to decide suits between aliens or between aliens and citizens. In 227 B.C., the number was increased to four, the two additional praetors being elected to act as governors of provinces in Sicily and Sardinia. The number was increased to eight by Sulla, to 10 by Julius Caesar, and still later to 16. These officers were elected by the people, and, after holding their offices for one year, they were sent out by lot as governors of provinces, when they were known as *propraetors*.

Praetorian Guard (*prẽ-tõ'ri-an gärd*), the

bodyguard of the Roman emperors, which was organized by Augustus to take the place of the old bodyguard attached to the person of the commander-in-chief of the Roman army, such as attended Scipio Africanus. Emperor Augustus formed 9 or 10 cohorts, which consisted of 1,000 men each, and included both infantry and cavalry. Only three of these were kept at Rome, while the others were stationed in different cities of the empire. The nine cohorts were centered at Rome by Tiberius, and Vitellius successively increased their number until 16 cohorts were organized. The praetorians held office for from 10 to 16 years, and their power became so great that they were able to raise and depose emperors at their will. Their high-handed sale of the throne to Didius Julianus, in 193 A.D., caused Septimius Severus to reorganize them by replacing their number with the most trustworthy veterans serving on the frontier. Constantine the Great finally dispersed them in 312.

Pragmatic Sanction (*präg-mă'ik sänk'-shün*), a term applied to a rescript issued by the head of a monarchy under the advice of his council to some order or body of people in relation to affairs of the state or the church. It was the custom of the princes of the Byzantine Empire to issue *rescripts* as declarations of law to individuals, but the solemn decrees issued by the sovereign became known as the *pragmatic sanction*. Since then it has been applied to solemn decrees issued in various countries. The most noteworthy include that of St. Louis in 1269, which contains articles against the assumptions of the Papacy; that of Charles VII of France, in 1438, embodying the most important decisions of the council of Basel; that of 1439, giving the house of Austria control of the empire of Germany; that of Emperor Charles VI, in 1713, which finally passed the sovereign authority to his daughter, Maria Theresa; and that of Charles III of Spain, in 1759, granting the throne of the two Sicilies to his third son and his descendants.

Pragmatism (*präg'mă-tiz'm*), a term used in philosophy to define a theory developed by Charles S. Peirce (1839-1914) and William James (1842-1910). It is characterized by the following concept (as first defined by Peirce): The truth of an idea should be evaluated by considering the practical consequences of this idea; the total amount of these consequences represents the true meaning of an idea. William James expanded this basic theory, stating that "the end of man is action." In other words, a knowledge or truth can be measured by actions resulting from it.

Peirce based his thinking on mathematical and logical methods, while James always deduced his from respective practical consequences. The latter even expounded the theory that if there are no practical differences between two alternatives, both meanings are practically the same and all

discussion about the difference would be superfluous. In all his writings James stresses the intrinsic importance of practical consequences; thus he emphasizes, for instance, that each individual reality is exactly what it is "known as." By this means, however, he almost denies completely the whole history of philosophy, since the main problem of most other philosophers has been to find the answer to what is behind reality.

This weight given to practice and practical consequences has been the reason for the tremendous popularity of this theory in America. Its founders, Peirce, James, and later John Dewey, have had great influence not only on philosophy in the narrow sense of the word but also on religious development and education in this country. Differences between the individual shades of pragmatism as developed by these three thinkers and by the younger Italian, Giovanni Papini, are shown, for instance, in their varying concepts of God. James states that if the hypothesis of God satisfies the individual it is true, an opinion which is not shared by Dewey. The claim that the pragmatic method of dealing with problems is the only truly scientific method can be explained historically only by the fact that when pragmatism was developed materialistic and empiricistic ideas dominated scientific thinking.

Prague (*präg*), the capital and the largest city of Czechoslovakia. It is on the Moldau, 152 m. n.w. of Vienna. The St. Vitus Church, a Gothic structure of the 14th century containing the remains of seven kings or emperors of Germany, the Hussite Church, with the grave of Tycho Brahe, the Roman Catholic cathedral, the Byzantine Church of St. George, the Theresa Institution for Ladies, the vast Czerni Palace, and several governmental buildings are notable features. It has fine public schools and hospitals, several charitable institutions, a royal library, and numerous public parks and gardens. The Univ. of Prague is one of the most noted educational centers of Europe.

Prague is centrally located on several railroads and is the seat of a large jobbing trade. Among the manufactures are cotton textiles, silk and woolen goods, boots and shoes, beet sugar, liquors, clothing, leather, scientific instruments, machinery, engines, hardware, and pottery. Prague was founded by Princess Libussa in 722. The great university attracted students from every part of Europe in the 14th century.

The Hussites conquered it in 1424, but it suffered greatly in the Reformation. Frederick the Great of Prussia captured it in 1744, and in the Seven Years' War it suffered or prospered according to the fortunes of battles. The Prussians occupied it in 1866, as the result of the Austro-Prussian War, which was terminated with the treaty signed here on Aug. 23, 1866. In 1918, it became the



Courtesy Czechoslovak Govt. Information Service, N. Y.

PRAGUE. STATUE OF KING WENCESLAS

center of political influence and the capital of Czechoslovakia. Prague was occupied by the Germans in March 1939. As Allied forces fought for the liberation of Czechoslovakia early in 1945, the population of the city rose against the German forces of occupation and hastened the final collapse of the Nazi troops. Population, *ca.* 850,000.

Prague, UNIVERSITY OF, an institution of higher learning in Prague, Czechoslovakia. Officially named Charles Univ., it was the first institution of its kind in Central Europe. Established as a German university in 1348, and comprising the four faculties of law, medicine, arts, and theology, a Bohemian section was added later, but closed when Bohemian influence declined. Religious and political conflicts wrought many changes upon it in shaping the courses and causing the attendance to fluctuate. In recent times religious influences have lost much of their old importance. The Czech movement in the 19th century brought about the re-establishment of the Bohemian section, which more recently outgrew in attendance the German department of the university. In 1939, Germany absorbed Czechoslovakia, and the Univ. of Prague once more came under German domination, resulting in the suppression of liberal education. After the liberation of Czechoslovakia from German occupation in 1945, the German Univ. of Prague was suspended.

Prairie (*prā'rī*), meaning meadow land, the name given by the early French settlers in America to extensive tracts of land which were destitute of trees. Subsequently the term was applied quite generally to the vast region lying between Ohio and Michigan on the east and the Rocky

Mts. on the west, extending northward into Canada. (See *Plain*.) The name applies locally only to fertile tracts which are entirely treeless, but, when speaking of prairie in the aggregate, considerable tracts of timber are necessarily included. The altitude of the great prairie region ranges from 100 to 2,000 ft. above sea level. At Cairo, Ill., and Keokuk, Ia., the altitude is about 400 ft., whence it gradually rises toward the north and northwest, giving the rivers a steady flow in all sections tributary to the Mississippi. The streams are bordered by belts of hardy and valuable timber, though there is a perceptible decrease in forest growth along the streams in some sections of Kansas, Nebraska, and the Dakotas, where portions of the surface are sandy and less productive than in other parts of these states.

This great prairie region includes fully 400,000 sq. m. It has a generally undulating surface and comprises one of the most valuable and productive regions of the world. In northern Iowa, western Minnesota, and the eastern part of the Dakotas beautiful clear-water lakes are abundant. Prairie soil is composed mostly of a black vegetable mold and formerly many species of nutritious grasses were abundant, but now the region is covered by fields of cereals, meadows, orchards, and gardens. Though stones for building purposes are abundant in some sections, the soil is remarkably clear and unobstructed for cultivation, and forms the most desirable extensive farming region of North America. Formerly vast herds of deer, elk, buffalo, and other animals were abundant, furnishing a prolific hunting ground for the Indians, but all these primitive conditions have

given way to railroads, cities, and cultivated fields. Portions of the prairie region lying west of the rooth meridian are subject to an arid climate, and irrigation is resorted to for the purpose of supplying the necessary moisture. However, all parts are capable of supporting vast herds of cattle, horses, and sheep without cultivation or irrigation.

Prairie Chicken (*prār'i chīk'ēn*). See *Grouse*.

Prairie Dog (*prār'i dōg*), an animal native to the regions both east and west of the Rocky Mts., but most abundant on the High Plains. Prairie dogs are rodent mammals. They are allied to the marmot and prairie squirrel, but differ from the latter in having a more bulky body, a shorter tail, and a voice resembling the bark of a dog. They live in groups known as *towns*, or *colonies*. Their burrows are peculiar for having many compartments and an elevated mound at the exit, the opening for passage being at the middle of the mound. Several sentinels are stationed at convenient places and at the approach of danger give warning to those who happen to be some distance from the colony. They are in no wise dangerous, though in some localities they devour much vegetable growth, and the quickness with which they enter their burrows on the approach of danger makes it exceedingly difficult to kill them. It is a remarkable fact that rattlesnakes and burrowing owls are sometimes found in the same burrows with prairie dogs.

Prairie du Chien (*prār'ē du shēn'*), county seat of Crawford County, Wisconsin, 60 m. s. of La Crosse. It is situated on the Mississippi River, has communication by the Chicago, Milwaukee, St. Paul & Pacific and the Chicago, Burlington & Quincy R.R.'s, and is surrounded by a fertile farming country. The principal buildings include those of the county, the Sanitarium, St. Mary's Acad. for girls, Campion Acad. for boys, and several fine schools and churches. Meat packing, decorated metal products, commercial fertilizer, concrete products, sand and gravel, cabinets and store fixtures, tools, chemicals, stock foods, and sawmills are the leading industries. The city-owned Villa Louis, former home of Col. Hercules L. Dousman, and the city museum show the history of the region. The last was built on the site of three of the five forts in the city of which the earliest was constructed in 1689. Fort Crawford II, partly restored by the Dr. William Beaumont Foundation, was the location where Dr. Beaumont performed some of his experiments (1828-32) on Alexis St. Martin, which gave to man some of the first important facts on the digestive system (see *Beaumont, William*). Zachary Taylor (*q.v.*) once commanded this fort and Jefferson Davis (*q.v.*) was a lieutenant under him here during the Indian Wars. The discovery of the Mississippi River by Marquette and Joliet, June 19, 1673, took place just south of the city at

the confluence of the Wisconsin River. The city was incorporated in 1872. Population, 1905, 3,179; in 1940, 4,622; in 1950, 5,392.

Prairie Squirrel (*prār'i skwār'ēl*). See *Gopher*; *Prairie Dog*.

Prairie Wolf (*prār'i wūlf*), or *COYOTE*, the Mexican name which was adopted in the Western U.S. It is a reddish-colored wolf, found from the Plains to the Pacific, and in Southern British Columbia. The coyote is famous for its nocturnal yelping which resembles the barking of a dog; it feeds on squirrels, mice, and birds; and attacks poultry, sheep, and cattle.

Pratt (*prāt*), CHARLES, merchant and philanthropist, born in Watertown, Mass., Oct. 2, 1830; died in New York City, May 4, 1891. He entered business at an early age in New York City, where he made a fortune in the oil and paint trade, and was a principal stockholder of the Standard Oil Co. Among his notable gifts to education are endowments to the Brooklyn Adelphi Acad. with which Adelphi Coll. is now affiliated, and the Pratt Institute (*q.v.*) of the same city.

Pratt, ENOCH, philanthropist, born in North Middleboro, Mass., Sept. 10, 1808; died in Tivoli, Md., Sept. 17, 1896. He was educated at the Bridgewater Acad. and in 1825 began business in Boston, but removed to Baltimore in 1831. He founded an institution for colored children at Cheltenham by donating 750 acres of land. Subsequently he founded the Maryland School for the Deaf and Dumb at Frederick, and in 1867 gave \$30,000 to an academy in the town of his birth. In 1882 he founded the Pratt Library in Baltimore by donating \$1,085,000. This library now has more than 40 branches, including about 900,000 volumes. He made a bequest of \$2,000,000 to the Shepherd Asylum, with the proviso that the name be changed to the Shepherd and Enoch Pratt Hospital.

Pratt Institute (*prāt in'stī-tūt*), a professional and technological school in Brooklyn, N.Y., founded by Charles Pratt in 1887, comprises four schools: art, home economics, engineering, and library science. Three distinct types of courses are offered: (1) Degree courses leading to the bachelor's degree; (2) certificate courses requiring from two to three years' full-time attendance; (3) unit courses offered in the evening. An endowment aggregating \$9,000,000 makes possible moderate tuition fees. Annual enrollment is about 5,000 students (*ca.* 2,900 men and *ca.* 2,100 women).

Praxiteles (*prāks-il'ē-lēz*), one of the greatest sculptors of ancient Greece, who lived and worked at Athens about 350 B.C., born about 400 B.C. Little was known of him personally even in the time of Pliny (*q.v.*), but it is certain that he was one of the most eminent of Greek sculptors, and that he and Scopas (*q.v.*) were leading representatives of the later Attic school. His works were



FAUN. SCULPTURE BY PRAXITELES

largely designed to display the beauty of Bacchic pleasures and the perfection of the human form, especially female figures. Among his most noted works were the statues of Aphrodite at Alexandria, Cnidus, and Rome, of which the one at Cnidus is the most celebrated, and proves Praxiteles' great mastery in dealing with the human body. Other works include the statues of Apollo, Eros, and Hermes carrying on his arm the infant Dionysus; the latter was discovered only in 1877—until then it was known only by literary documents. Although the statue is no longer perfect—one arm is lost—the face shows the full beauty of that era. It is generally believed that Praxiteles marks an epoch in the history of Greece and its reflection in art, since his sculptures show a transition from the heroic and reverential age preceding the Peloponnesian War to the more pleasurable forms of later times.

Prayer (*prār*), BOOK OF COMMON, the prayer book in use in the Church of England. In its present form it developed from a combination of several Catholic daily offices and services. Written in English, it was introduced by Edward VI in 1549, and further Protestant elements were added shortly after. Through the following centuries it was repeatedly revised, leaning sometimes toward Catholicism, sometimes toward Protestantism.

Praying Indians (*prā'ing in'di-anz*), term

PRE-CAMBRIAN

applied to North American Indians who were converted to Christianity in early pioneer times and fought on the side of the English.

Praying Wheel (*prā'ing hwēl*), a device varying in form from a small drum or case to a great wheel containing a long strip of paper on which prayers or single sentences are written. Tibetan Lamaists utilize the praying wheel, turned by hand, wind or water, as a substitute for oral prayers.

Preaching Friars (*prēch'ing frī'ērz*), or DOMINICANS, a monastic order founded in 1215 by Dominic de Guzman. The function of the order was first to preach and later to maintain a mission. Dominicans are pledged to absolute poverty and are therefore sometimes known as one of the *Beggar Orders*. Due to the intellectual discipline required for preaching, some of the greatest of medieval thinkers, particularly scholastic theologians, were of this order, e.g., Albertus Magnus (*q.v.*) and Thomas Aquinas (*q.v.*). The Dominicans were among the Inquisitors of the Counter-Reformation.

St. Dominic actually founded three orders: the Dominican monks, the Dominican nuns, and the so-called Third Order. The members of the last mentioned are allowed to live in the world, but they must observe certain vows. Many people belong to the Third Order without the knowledge of their neighbors until death, when they are buried in their cowls.

Preble (*prēb'l*), EDWARD, naval officer, born at Portland, Me., Aug. 15, 1761; died there Aug. 21, 1807. He became a privateer in 1777 and was made a midshipman in 1779, but was captured by the British soon after. However, he was released in a short time and served on the *Winthrop* until the close of the war. In 1782 he distinguished himself by capturing a British brig off Castine, Me., and was appointed to command the *Essex*. Later, in 1803, he commanded a squadron against Tripoli. After blockading the port of Tripoli, he bombarded the place repeatedly, but was relieved by Commodore Barron in 1804 and returned home. Congress presented him with a gold medal and a vote of thanks for his service.

Pre-Cambrian (*prē-kām'brī-an*), the largest, oldest division of geologic time. It includes all of the oldest rocks of the earth which are, in large part, unfossiliferous and highly contorted and distorted. The oldest rocks known are from Murmansk, Russia; their age, indicated by the radioactive minerals they contain, is nearly 2,000,000,000 years. The youngest rocks of the Pre-Cambrian period are dated at about 500,000,000 years, thus including the oldest three-fourths of all geologic time.

Although it seems certain that there was abundant, if primitive, life in the Pre-Cambrian age,

direct evidence such as fossils is almost totally lacking. There are only two accepted fossil organisms from the Pre-Cambrian, calcareous algae and trails and burrowings of wormlike animals. The large amount of graphite disseminated through much of Pre-Cambrian time, however, strongly suggests the existence of soft-bodied organisms that were not fossilized because they had no skeletons.

The Pre-Cambrian rocks probably have world-wide distribution but are covered by later rocks throughout four-fifths of the continental land surfaces. Large areas of Pre-Cambrian rocks are found on all the continents. Most of eastern and northern Canada is composed of these ancient complex rocks; eastern Brazil and the Guiana region of South America and the Scandinavian Peninsula in Europe are almost entirely Pre-Cambrian. Central Siberia, western Australia and eastern Africa all contain large areas of these old rocks. There are many other smaller outcrops throughout the world.

Pre-Cambrian climatic conditions varied, and there is good evidence of at least one large ice age in this era.

The large iron deposits in the U.S., Sweden, and Brazil are all contained in Pre-Cambrian rocks; 85 per cent of the iron produced by the U.S. comes from the Pre-Cambrian range of the Lake Superior region, and large amounts of copper are produced in the same vicinity. Sudbury, Ont., produces large amounts of nickel and cobalt; Ontario also yields enormous quantities of silver. One of the greatest sources of radium is the Pre-Cambrian strata at Great Bear Lake of northwest Canada; the Union of South Africa also produces large amounts of gold from these rocks.

Precession (*prê-sêsh'ûn*), the slow motion of the axis of rotation of the earth which changes the intersection of the earth's equator with the plane of the ecliptic from east to west at the rate of 50.26" per year. It was discovered in 125 B.C. by the Greek astronomer Hipparchus by comparing his observations of the seasons and the rise of the stars with those of his predecessors. Newton showed that it is caused by the gravitational effect of the moon and the sun on the equatorial bulge of the slightly oblate earth. Under its influence the axis of rotation of the earth describes a cone around the axis of the ecliptic in a period of 25,800 years. While the pole of the equator is now near Polaris, 12,000 years hence it will be located near Vega in the constellation of Lyra, which star then will deserve the name of Pole star. Thus the visibility of the constellations changes in the course of time.

Precious Stones (*prêsh'ûs stônz*). See *Diamonds*; *Lapidary Art*; *Stones, Precious*.

Precordial Pain (*prê-kôr'jal pân*), in medicine, pains in the precordia, the part of the chest which lies over the heart, sometimes caused by indigestion.

Predestination (*prê-dês-tî-nâ'shûn*), a theological term meaning generally God's salvation of man. The idea of predestination is influenced by two fundamental Christian concepts, the one being that of the original sin (*q.v.*), condemning man, and the other that of salvation and redemption of man by the grace of God, offered through the sacrifice of Christ. The opposite tendencies of these two concepts created the greatest theological difficulties and controversies from St. Augustine and Pelagius to Calvin (*qq.v.*), to mention only three of the theologians whose life work centered around this thought. The problem as such can be encountered in the writings of the early Greek philosophers, as well as in variants of Jewish thought, but we find it not less in Brahmanic, Buddhist, and especially Mohammedan philosophies.

Briefly, the doctrine of predestination supposes that the eternal destiny of man is predetermined by God, an idea which was first presented by the Jewish prophets. Christian thought, however, combines this idea with the concept of grace. There is a line from the apostle Paul to St. Augustine to Luther and Calvin, all of whom emphasize the predestined fate of man who can be helped only by grace. According to their teachings, God has chosen who will be saved and has decided from the beginning who is going to be condemned. In contrast to this idea, Pelagius (*q.v.*) believed that it is man's own free will which forms his future destiny, although helped by God's grace. Thomas Aquinas (*q.v.*) was definitely nearer to St. Augustine than to Pelagius, as were the various reformers later on, although with slight variations among themselves. The most conservative among them was Calvin, whose opinion was that man could not do anything to change his destiny.

Actually, to bring into harmony the idea of predestination by God and the idea of the free human will still is the central problem of the believing Christian, one might even say of the believing monotheist. Generally, it may be said that after the Reformation in the 16th century the trend of Christian thought gradually emphasized more and more man's own responsibility.

Pre-emption (*prê-êmp'shûn*), the right of purchasing land before others, a privilege accorded by law to an actual settler upon public lands under certain conditions. The first pre-emption law was passed in the U.S. on Mar. 3, 1801, and was designed to encourage colonization on the Miami River. A large number of special pre-emption acts were passed before 1830, but in that year the first law of a general char-

PREFABRICATION

acter took effect. The general law of 1841, which was repealed in 1891, gave actual settlers a prior right of purchase in 160 acres of public land. It was necessary to file a declaratory statement within 30 days after making settlement, and a final receipt was issued on proof of settlement and cultivation within a year after the declaratory statement was made. The price was \$1.25 per acre for lands outside the limits of railroad grants and within such limits, \$2.50 per acre. The right of pre-emption extended to all persons over 21 years of age, who were unmarried or the heads of families, and those desiring to do so could convert a pre-emption claim into a homestead. Under the pre-emption law title could be secured to public land within a shorter time than under the homestead act, but those taking advantage of the latter received title without making any payment for the land.

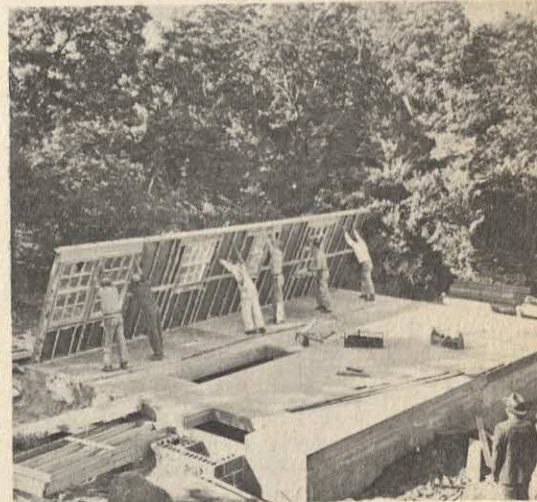
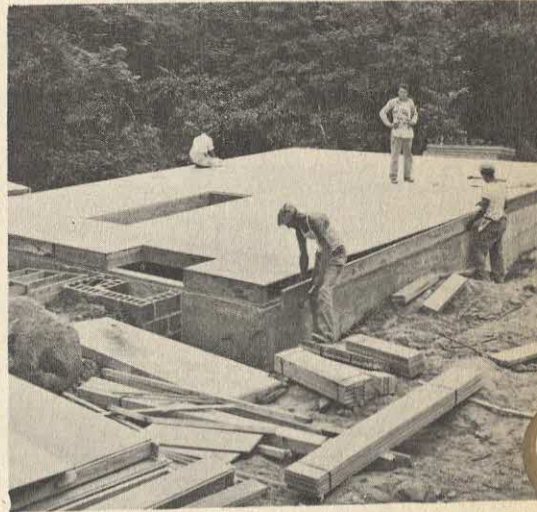
Prefabrication (*prē-jāb-rī-kā'shūn*), the name which has become popularly associated with the method of producing homes and their component parts through the application of modern industrial techniques. Prefabrication means: To fabricate all the parts of a house or a bathroom unit in a factory, so that construction consists merely of assembling and uniting the parts.

A prefabricated home may be defined as one having floors, walls, ceilings, and roof composed of sections or panels which have been shop-fabricated prior to erection on the building foundation. This is in contrast to the conventionally built house constructed piece by piece at the site. Though many buildings have been constructed of panels fabricated at the site, the term prefabrication generally implies factory production and transportation to the site.

The ready-cut house may be considered as the forerunner of the prefabricated house. These "mail-order" houses were sold all over the country, especially during the 20-odd years prior to 1940. The wood framing, siding and other members were pre-cut and marked for erection. Except for fabricated units such as doors and windows, the house was assembled piece by piece at the site.

The typical prefabricated house of today first appeared on the market in the period 1935-40. Many experimental attempts have taken place since 1920, however. Out of the various trials, Corwin Willson's trailer house, Buckminster Fuller's Dymaxion house—which developed an igloo-like structure adapted from grain bins—and Martin Wagner's steel igloo house may be mentioned. About a dozen established prefabricators were successfully distributing permanent-type attractive homes just before World War II and had produced about 10,000 units up to that time.

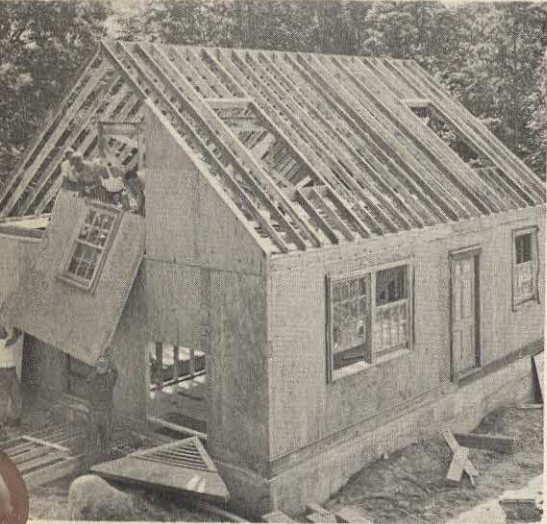
The infant industry grew to sizable stature during the war years. An estimated 200,000 or



Photos in this series courtesy American Houses, N. Y.

STEPS IN THE ERECTION OF A PREFABRICATED HOUSE

PREFABRICATION



FINAL STEPS IN THE CREATION OF A PREFABRICATED HOUSE

more temporary housing units and a number of other war items were quickly manufactured by as many as 70 to 80 producers who became engaged either temporarily or permanently in prefabrication. The industry after the war embraced a rapidly increasing number of prefabricating plants and now holds promise of becoming an important factor in the construction field.

The typical prefabricated house of today is made up of panels of convenient size for handling, usually not less than 4 ft. wide. A wall panel may be solid or it may contain a door or window. Many prefabricators make room-size and wall-size panels. By this method, one side of a room or the whole side of a house including doors and windows can be factory-built as a single unit. Other houses offered are combinations of panelized, ready-cut and prefinished parts. Several manufacturers encourage prospective home-owners to design their homes to suit

themselves, using as the basis a selection of standardized panels, porches and garages. Most producers, however, offer several basic designs, providing a rather extensive selection of exterior treatments.

A few manufacturers sell houses which are prefabricated and completely assembled at the factory. The shipping width of such houses is necessarily limited so that they can be delivered by truck. However, two or more of these truckable units may be fastened together at the building site to form a home.

In addition to these conventional-type prefabricated homes, there are prefabricated dwellings consisting of panels of aluminum, plastic materials, and pre-cast concrete sections, which still are largely in experimental stages. These units have been referred to as the "industrialized" house.

The manufacturer of prefabricated houses requires the use of substantially all of the materials found in conventional homes, but in different proportion. Because ease of handling is important, the lighter materials predominate, i. e., lumber, lumber products—especially plywood—and all kinds of building boards. The use of heavier materials such as brick usually is restricted to foundation walls and chimneys. Lightweight metals and lightweight concrete have been used to some extent, and new materials may be expected to come into the picture as wartime developments are converted to peacetime uses. Research to improve materials, combined with the fabrication and erection experience to be gained during the next few years, should result in continued improvement of prefabrication techniques.

In many cases prefabricators use jig tables on which they produce sections similar to conventional-type construction. They lay out pre-cut lumber in a form and nail and/or glue plywood or other material on this framework. For wall sections, shingles or other exterior finish may be applied in the shop or in the field. Insulation material is generally built into the panel in the factory.

Other prefabricators who have an assembly line production method, like an automobile factory, often make another type of panel construction called the "stressed-skin" principle. Sheets of plywood are permanently bonded with new adhesives in large presses to the framing, which gives great structural strength without the bulk of conventional methods.

Quality standards for prefabricated homes are set forth in Commercial Standard CS125-45, which was formulated by Prefabricated Home Manufacturers' Institute, trade association of the industry, in co-operation with the National Bureau of Standards, U.S. Dept. of Commerce.

PREFERENTIAL TARIFF

The standard is primarily one of performance rather than a specification type and leaves the choice of materials and methods to the ingenuity of the prefabricator. It covers strength of the component parts, requirements for foundations, chimneys, insulation, plumbing, heating and electrical work. It also includes general requirements for materials, erection, workmanship, and protection of panels during transportation and erection.

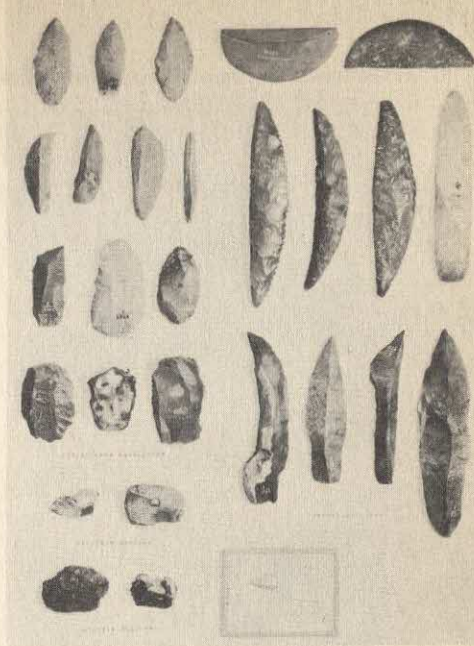
Members of the trade association build their homes to conform with these standards and stand ready to issue a certificate of conformity to the home buyer which assures him of durable and lasting construction.

Prefabricators have as their objective to make available better houses much faster and more economically than is possible by other building methods. They cite the following advantages of prefabrication:

1. Prefabricated houses are completely engineered for maximum comfort, strength, and convenience.
2. Accuracy and high quality workmanship result from the use of efficient mechanical equipment under good factory working conditions.
3. Mass production methods effect substantial economies all along the line. The advantages occasioned by purchasing materials in large quantities directly from the producer and elimination of waste through employment of factory methods are reflected in lower cost to the purchaser.
4. The speeding up of on-site operations possible with prefabricated houses is of great advantage to the builder. The house can be put under roof in a matter of hours, thus minimizing the possibilities of exposure to unfavorable weather.

Preferential Tariff (*prěf'ēr-ěň'shəl tār'is*), a schedule of duties on imports which are established by an importing country so that certain of the countries from whom goods are received are favored with lower taxes (on some or all commodities) than other countries. An example of a preferential tariff arrangement was that instituted by the British Empire in 1932 for the purpose of binding together Great Britain and her dominions into a group with mutual trading advantages for the various participants. See also *Customs Duties; Reciprocity; Tariff*.

Pregl (*pră'g'l*), FRITZ, chemist, born Sept. 3, 1869, at Laibach, Austria; died in Graz, Austria, Dec. 13, 1930. He received the degree of doctor of medicine at the Univ. of Graz in 1894, and then became assistant professor at the Physiological Institute there. He subsequently taught at the Medico-Chemical Institute at Graz and at the Univ. of Innsbruck, and in 1913 became director of the Medico-Chemical Institute at Graz. Pregl is notable for his discovery of chem-



All pictures in this series courtesy American Museum of Natural History, N. Y.

EVOLUTION OF CUTTING IMPLEMENTS

Pleistocene Paleolith, Pliocene Eolith, Miocene Eolith, and Recent Neolith periods

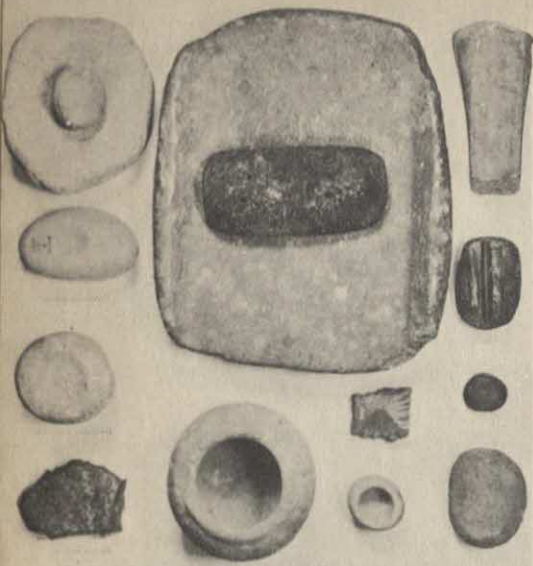
ical microanalysis, for which he won the 1923 Nobel Prize in chemistry. His method eventually became so well developed that it was possible to take little more than half a milligram of an organic substance and to analyze its composition with perfect accuracy. In addition to inventing this method, Pregl was also responsible for developing many of the tools and devices necessary for handling and weighing such small amounts of material. He published "Quantitative Organic Microanalysis" in 1917.

Pregnancy (*prěg'nān-sŷ*), in biology, the state of a female animal or human from the time of conception to the birth (*q.v.*) of the young. In humans, pregnancy covers about 280 days. Typical early symptoms are morning nausea, and cessation of menstruation. The condition sometimes causes skin and kidney ailments.

Pre-History (*prě-his'tō-rŷ*), a period in the development of the world and especially in the growth of the human species from its beginnings up to the stage of written history (about 5000 B.C.), and therefore sometimes called *pre-literary* history. Lacking written reports, students of the pre-historic period, which began for man about 1,000,000 years ago, base their reconstruction on excavations of implements, weapons, evidences of cultural development, and fossil or skeleton remains (jaws, skulls, etc.). Periods of human development may be divided chronologically as follows:

From the *Middle Pleistocene* or *Ice Age*

PRE-HISTORY



Courtesy American Museum of Natural History, N. Y.

EVOLUTION OF GRINDING IMPLEMENTS

Recent Neolith, Pleistocene Paleolith, and Miocene Eolith periods

have come the earliest remains resembling man. These include *Pithecanthropus erectus* (q.v.) or Java Man; *Sinanthropus Pekinensis* or Peking Man (q.v.); *Homo Heidelbergensis* or Heidelberg Man (q.v.); and *Eoanthropus* or Piltown Man (q.v.). The Ice Age shows evidences of fire and stones.

In the *Late Pleistocene* period came the *Paleolithic* or *Old Stone Age*, giving us the Neanderthal Man (q.v.), often considered the first true man, and *Homo Rhodesiensis* or Rhodesian Man (q.v.), and the use of stones, flints, fire, and caves.

Highly ornamented and carefully buried skeletons, such as the Grimaldi Man (q.v.), reveal the more advanced cultural development of the *Late Paleolithic Period*. Thereafter, traces of man become increasingly numerous, and his development may best be traced by reference to the accompanying cultural periods. These periods of the Late Paleolithic Age, for instance, include *Aurignacian*, *Solutrean*, *Brno*, *Magdalenian*, *Tardenoisian*, and *Asturian*. The last phase of the Paleolithic (often called the *Mesolithic*), and the first sign of the *Neolithic Period* may be divided into the *Maglemosean*, *Kitchen-Midden*, and *Campignian* periods of cultural advancement. Up to the beginning of the *Neolithic* or *New Stone Age*, hunted animals rather than crops or plants served as food for mankind.



Courtesy American Museum of Natural History

EVOLUTION OF CHOPPING IMPLEMENTS

Recent Neolith and Pleistocene Paleolith periods



Courtesy American Museum of Natural History, N. Y.

EVOLUTION OF POUNDING IMPLEMENTS

Recent Neolith and Pleistocene Paleolith periods

Since the large classifications of pre-history are usually based upon the type of implements employed, the preceding division as a whole is referred to as the *Stone Age*, including the Old Stone Age and the shorter but more progressive New Stone Age. Great cultural development was made during the latter period, characterized by ground and polished tools, pottery, dwellings other than caves, and domestication of dogs, goats, sheep, and other animals.

Still within the province of pre-history are the ages of metals (gold, silver, copper, bronze). During the *Bronze Age*, best known of these periods, metal largely replaced stone in ornaments, such as bracelets, and in such weapons as swords, daggers, and spearheads. The last, and probably the most highly developed of the three large divisions, is known as the *Iron Age*, during which iron replaced bronze as the metal commonly used for weapons, tools, and ornaments. During this period phonetic writing was invented, so that here pre-history begins to merge with the Age of History. See also *Archaeology*; *Man*.

Premium Wage System (*prēm'wāj wāj sīstēm*), a system of wage incentives in which the basic wage is supplemented by an additional payment depending upon quality or quantity of work done, or upon amount of time saved. Some companies distribute bonuses at the end of the year out of part of the profit. Special bonuses are sometimes given when an abnormal increase in the cost of living occurs.

Prentice (*prēn'tis*), GEORGE DENISON, journalist, born in Preston, Conn., Dec. 18, 1802; died in Louisville, Ky., Jan. 22, 1870. He was graduated from Brown Univ. in 1823, studied law, and in 1829 was admitted to the bar. He became editor of the *New England Review* and in 1831 of the *Louisville Journal*, which position he held until his death. His newspaper championed the Whig party and supported the Union cause throughout the Civil War. Prentice made his paper popular and influential by witty criticisms and able editorials. Among his published works is "Prenticeana, or Wit and Humor." The *Louisville Journal* was consolidated with the *Courier* after his death and is now known as the *Courier-Journal*.

Prentiss (*prēn'tis*), BENJAMIN MAYBERRY, soldier, born at Belleville, Va., Nov. 23, 1819; died at Bethany, Mo., Feb. 8, 1901. At the age of 16 years he accompanied his parents to Missouri and later settled near Quincy, Ill. He served as a captain of volunteers during the Mexican War, distinguishing himself in several engagements, and at the beginning of the Civil War was commissioned a colonel in the Federal army. In 1863 he resigned from the army, having risen to the grade of major general. At Shiloh, he defended

a position assigned to him by Gen. Grant, refusing to relinquish it without special order, and was captured. After the war he was active in the Grand Army of the Republic. He was a member of the court-martial which tried and cashiered Gen. Fitz-John Porter (*q.v.*).

Preposition (*prēp-ō-zish'ūn*), in grammar, a part of speech which shows the relation between its object and some other word. In English the preposition generally precedes the noun which it governs. Grammarians usually agree that prepositions were originally either verbs or nouns, and generally class them with relational words. About 40 prepositions are used in English, besides a number of participles that are employed as inseparable prepositions, such as *be-stir* and *be-speak*. In Greek there are 18 prepositions and in Latin there are about 50.

Pre-Raphaelitism (*prē-rāf'ā-ēl-ī-tiz'm*), the designation applied to an organization of English artists, whose members avowed preference for the great masters who lived before the time of Raphael and drew inspiration for their work from nature and the purity of Christian art rather than from following technical rules. This organization, originated in 1848, was designed to found a new school of artists who would make the study of nature their direct object. With Dante Gabriel Rossetti as their leader, his brother William Michael Rossetti, John E. Millais, William Holman Hunt, Frederick George Stephens, Charles Collinson, and Thomas Woolner formed the initial group. In the Free Exhibition, held in London in 1849, Rossetti exhibited his "Girlhood of the Virgin,"



PRE-RAPHAELITISM

Self-portrait by Dante Gabriel Rossetti (1828-82)

Hunt presented "Rienzi," and Millais brought forward his "Lorenzo and Isabella." These works were highly complimented. In their art, they aimed at a pure, sincere interpretation, as a reaction against the pseudo-classic tendencies of their contemporaries. However, adverse criticism of the newly formed brotherhood arose, partly from the jealousy of contemporary painters. The discussion continued for some years somewhat to the disadvantage of the Pre-Raphaelites, but Ruskin (*q.v.*) published several extended letters in the London *Times* in denunciation of those who assailed the new school and its promoters, and pointed out that good would likely result from the merit of their work and efforts. The reflection of this movement in literature may rightly be connected with tendencies of the Romantic movement.

Presbyopia (*prĕz-bi-ŏ'pĭ-a*), in medicine, farsightedness occurring in older people. As a person advances in age, the elasticity of the crystalline lens diminishes, thus reducing the focusing ability of the eye.

Presbyter (*prĕz'bi-tĕr*), the title of an official in the Christian church, derived from the synagogue. The name is used interchangeably with bishop in the New Testament. At first the title was given because of age or dignity, and later a board of presbyters was maintained. In some cases they were appointed by the apostles and in others they were elected by the people. They were ordained by prayer and the laying on of hands. In the 2nd century they filled a position immediately between that of deacon and that of bishop. It was their duty to discipline, teach, preach, receive strangers, visit the sick, and preside at the meetings.

Presbyterian (*prĕz-bi-tĕ'ri-an*), refers to a branch of the Christian church which bases its doctrine and form of government on the Bible. Lay elders participate with the clergy in conducting its affairs through a series of representative councils or judicatories of ascending importance. These begin with the *session* which exercises oversight over the local church, and advance through the *presbytery* which holds regional jurisdiction, to the *synod* which possesses powers of review, and culminate in the *general assembly* whose decisions are final. The powers of these councils are legislative, executive, and judicial.

The New Testament frequently mentions elders in the conduct of the apostolic church, whose functions in turn derive from the elders of the earlier Hebrew synagogues. The Greek word *presbuteros* means elder. But the democratic and representative character of the apostolic church gradually gave way to the power of the monarchical bishop.

With the enlightenment of the Renaissance

men rediscovered the Bible and found in it the guide to a Reformed church. As early as 1523 a council met in Zurich, Switzerland, and crystallized the opinions of leading Christian thinkers by declaring for equal representation of laymen with clergy in the government of the church and asserting the equal rank of all clergy. The city of Geneva adopted similar principles in 1535 under the leadership of John Calvin who, two years later, published his *Institutes of Religion* which established the Presbyterian pattern for Reformed churches throughout Europe. Thus did the stream of Christianity divide into the Roman and Reformed churches.

During a period of exile from Scotland, John Knox collaborated with Calvin in Switzerland and later returned to Edinburgh where he reorganized the Church of Scotland into the Presbyterian Church in 1560. Likewise, refugees from England learned the Presbyterian system on the continent and returned to their native land, where the first Presbyterian church was established at Wandsworth, just outside of London, in 1572. In the following century Parliament called into being the Westminster Assembly in 1643 which spent five years in formulating the confession of faith and catechism; these have since served as the basis for the standards of the Presbyterian churches throughout the world.

Oppression drove thousands of Presbyterians, along with other dissenters, from the countries of western Europe to America. Most numerous of these were the Scotch-Irish. Although some Presbyterian congregations existed among the earlier colonies, the first Presbytery was not organized until 1706. For 10 years before the American Revolution representatives of the Presbyterian Synod of New York and Philadelphia, and of the Connecticut Congregational Association, met annually in an attempt to prevent the appointment of an American bishop by the Church of England. In the early 19th century these two bodies entered into a plan of union by which, for nearly 50 years, they were to provide spiritual leadership for new communities in the westward trek of Americans. As the country expanded to the Pacific, mission boards kept pace with the growing population and also sent hundreds of missionaries to foreign lands. High standards of education for ministers have been maintained and a number of colleges have been encouraged.

Today the Presbyterian Church in the U.S. has a membership of more than 2,000,000. In 1873 the general assembly sponsored the organization of the alliance of the Reformed churches throughout the world holding the Presbyterian system which now includes 117 denominational bodies in its membership, representing 40,000,000 people.

Presbytery (*prěz'bi-tēr-y*), a term referring to a body made up of all the ministers and one ruling elder from each Presbyterian congregation within a certain district. It is the next higher body above the elders and ministers of a local congregation, who together constitute the session, and it ranks below the provincial synod, to which appeals can be made from the presbytery's decisions. This body has the authority to deal with appeals and complaints from local church sessions, and to license and ordain candidates for the ministry. It also installs or removes ministers. It reviews the records of church sessions and has supervision of discipline and doctrine. The presbytery may unite or divide or form new congregations. Since every church has a right to be represented in this body, the presbytery exemplifies representative government in the affairs of the church.

Prescott (*prěs'kūt*), county seat of Yavapai County, Arizona, 113 m. N. of Phoenix, on the Atchison, Topeka & Santa Fe R.R., and U.S. highway 89. It occupies an elevated site among mountains, which have deposits of copper, gold, silver, lead, and zinc. The surrounding country produces wool, lumber, and cattle. Among the noteworthy buildings are the county courthouse, the U.S. Veterans' Hospital, St. Joseph's Acad., the Federal building, and a number of churches. It has machine shops, waterworks, and a large trade in grain and livestock. It was founded in 1864. Population, 1940, 6,018; in 1950, 6,764.

Prescott, WILLIAM, soldier, born at Groton, Mass., Feb. 20, 1726; died Oct. 13, 1795. He served in the expedition against Cape Breton in 1754 and was promoted to captain in 1756. He returned to his home at Pepperell, Me., and in 1775 took command of a regiment of minutemen. He took part in the Battle of Lexington, commanded at Bunker Hill, and in 1777 cooperated in the campaign against Burgoyne at Saratoga. After the Revolution he served in the legislature of Massachusetts. The saying, "Don't fire till you see the whites of their eyes" (*q.v.*), has been attributed to him.

Prescott, WILLIAM HICKLING, historian, born in Salem, Mass., May 4, 1796; died in Boston, Mass., Jan. 28, 1859. A grandson of William Prescott (*q.v.*), he was graduated from Harvard Univ. in 1814. An accident at college resulted in the loss of his left eye and eventually in total loss of sight. A law student at first, he decided to engage in literary work and made an extended tour of Europe. Prescott's first writings, essays and criticisms, were published in the *North American Review*. His early studies were devoted largely to Italian literature, but in 1826 he began the study of Spanish history, and, after 10 years, completed the "History of Ferdinand and Isabella." The "History of the Conquest of Mexico,"

begun in 1838, was completed in 1843. In 1847 he published his "Conquest of Peru," and three volumes of his unfinished "History of the Reign of Philip II, King of Spain" were published from 1855 to 1858. Prescott's fame rests largely on his vivid style, since his histories have been partially superseded by later research.

Prescription (*prě-skřip'shūn*), in law, the right or title acquired by possession, to either personal or real property. It is the natural rule of the law that a person who has been for a long time in possession of property shall be regarded as the owner of it. This rule originated from the fact that men are naturally inclined not to give up what belongs to them, and from the additional circumstance that it would be unreasonable to assume without proof that the possessor is a usurper. Formerly a right acquired by possession was based upon immemorial adjointment, but finally the term was shortened by statute to 60 years and ultimately to 20 years, which is now the time required to acquire title by possession in most subdivisions of Great Britain and the U.S.

In *medicine*, a prescription is a written direction for making up and for using a medicine, or it can refer to the medicine itself.

President (*prěz'i-dēt*), the chief elective head of an organization. This is the official title of the supreme executive officer of the U.S. The term president was first used in America by William Penn, who proposed a scheme for the general government of the colonies, in 1697, and gave its chief executive that title. The Albany Congress proposed the title *president-general*. The Continental Congress termed its presiding officer *president*. The Articles of Confederation called for an executive board of 13, one from each state. They had no power except during the recess of Congress, since that body possessed the executive power while it was in session. The presiding officer of the Congress under the Articles of Confederation was officially titled President of the United States in Congress Assembled. John Hanson (1721-83), of Maryland, elected to that post in 1781, was the first such presiding officer; the post itself was comparable to the combined posts of Speaker of the House of Representatives and president pro tempore of the Senate. The constitutional convention of 1787 decided that there should be a single executive, to whom the title of President was given; George Washington was the first American President under the Constitution.

The term of office of the President is four years; no President may be elected more than twice or serve for more than 10 years. Presidents chosen for two or more terms are Washington, Jefferson, Madison, Monroe, Jackson, Lincoln, Grant, Cleveland, McKinley, Wilson, F. D. Roosevelt, Eisenhower; Cleveland did not succeed himself as



GEORGE WASHINGTON TAKING THE OATH OF OFFICE AS FIRST PRESIDENT

President. F.D. Roosevelt, who was elected four times, was the first President of the U.S. to be elected for more than two terms. Seven Vice Presidents succeeded to the Presidency on account of the death of the Presidents. The chief executives who died in office are William H. Harrison, who was succeeded by John Tyler in 1841; Zachary Taylor, by Millard Fillmore in 1850; Abraham Lincoln, by Andrew Johnson in 1865; James A. Garfield, by Chester A. Arthur in 1881; William McKinley, by Theodore Roosevelt in 1901; Warren G. Harding, by Calvin Coolidge in 1923; and F.D. Roosevelt, by Harry S. Truman in 1945.

The President must be a natural-born citizen having resided at least 14 years within the U.S. The age of eligibility is 35 years and the salary is \$100,000 per year, plus the use of the White House (*q.v.*) and \$90,000 for expenses. In 1958 Congress approved a pension entitling ex-Presidents to \$25,000 a year for life and their widows to \$10,000 a year for life, unlimited free mailing privileges, and up to \$50,000 a year for office help.

The President's duties include concluding treaties with Senate advice and consent, and, with Senate approval, appointing cabinet officers, ambassadors, ministers, consuls, and postmasters. He may grant reprieves and pardons, except in impeachment cases. He may request the opinion of any cabinet officer on the duties of his office, and he has the power to veto any bill passed by Congress, though a measure may become a law without his signature, if two-thirds of the members of each house vote to pass the bill over his veto. The President has appointive

power with the consent of the Senate of judges of the Supreme Court, and all other officers of the U.S. whose appointments are not otherwise provided for. He is also commander in chief of the Army and Navy. As the Chief Executive, he must see that the laws are obeyed, and he may convene Congress in extraordinary session, in order to furnish that body with information concerning the government.

Under the Presidential Succession Act of 1947, the order of succession to the Presidency is as follows: the Vice President, the Speaker of the House of Representatives, the president pro tempore of the Senate, the Secretary of State, the Secretary of the Treasury, the Secretary of Defense, the Attorney General, the Postmaster General, and the remaining officers of the cabinet in chronological order of the dates of their departments' establishment. The Presidential Succession Act of 1886, superseded in 1947, made no stipulation for the succession into office of the Speaker of the House of Representatives or for the president pro tempore of the Senate, nor did it provide for future cabinet members, with departments established subsequent to the Act's passage in 1886. Up to the ratification of the Twelfth Amendment, in 1804, the President and Vice President were not voted for separately in the electoral college, but the one obtaining the highest number of votes became President and the second highest, Vice President. Thomas Jefferson and J.Q. Adams were elected President by the House of Representatives, and Richard M. Johnson was chosen Vice President by the Senate when there was no majority or an election tie.

The election of Presidential electors occurs in

years which are perfectly divisible by four, every fourth year (the first election occurred in 1789) and is held on the Tuesday after the first Monday in November in all the states. The electors chosen meet in the capitals of their respective states to cast their votes for President and Vice President. From each state the votes are certified to the President of the Senate, who counts them in the presence of both houses of Congress, and the newly chosen President and Vice President are inaugurated on the 20th of January. Before 1937 the inauguration date was March 4. Before entering upon his duties, the President is required to take an oath, stating that he will faithfully execute the duties of his office and, to the best of his abilities, preserve, protect, and defend the Constitution of the United States. See *Electors; United States*.

Presque Isle (*prĕsh-ĭl'*), a city of Aroostook County, Me., 42 m. n.w. of Houlton, on the Canadian Pacific, the Bangor & Aroostook, and other railroads. It is the center of a large potato producing area; other products include grain, peas, hay, and lumber. It is the seat of Aroostook State Teachers Coll. Presque Isle was settled in 1820, incorporated in 1859, and chartered as a city in 1940. Population, 1950, 9,954.

Press (*prĕs*). See *Journalism; Newspapers; Periodicals; Press, Freedom of the; Yellow Press*.

Press, FREEDOM OF THE, the right of every citizen to publish what he chooses, subject usually only to certain legal restrictions for the protection of the public, the government, and individuals or corporations against unjust abuse. Freedom of the press first came into existence in England with the expiration of the Licensing Act in 1695. Before that time the rights of censorship and of licensing published matter belonged to the crown.

On the European continent the extent of this freedom varies with the country and in many states it is still abridged for political or other reasons. In America the Constitution originally made no provision regarding the liberty of the press, and it was regulated by the states according to the established opinion of the people. In 1776 the states of Pennsylvania, Maryland, Delaware, and North Carolina adopted constitutions containing the earliest declarations in favor of freedom of the press, and the first Congress passed an amendment to the Constitution as part of the Bill of Rights, providing that Congress shall make no law abridging freedom of speech and of the press.

The restrictive laws on the liberty of the press are several. The protection of the government is provided for by statutes condemning published matter constituting contempt of court, sedition, criminal anarchy and, in some states, syndicalism. The individual is protected by the libel law, the most important law in connection with the press. Published matter is libelous if, in the opinion of a substantial number of right-thinking

people, it induces an ill opinion of an individual or affects injuriously a person's business or professional standing, or impugns the credit and management of a corporation in such a manner that it is likely to cause pecuniary loss. However, a complete defense against this law may be made if it can be established that the published matter was true and published in good faith in the interest of the public. Copyright laws protect the author and, in the interest of public welfare, most states prohibit the publication of obscene matter.

The liberty of the press has been regarded a matter of supreme importance for the good functioning of democracy. Controversies regarding the interpretation of this freedom have raged for many centuries, and have not been resolved yet. Arguments vary between two extremes: one side contends that liberty of the press means no restrictions before publication, but that after publication the state is free to punish anything it considers objectionable; the other extreme insists that there is no legal responsibility for any published matter with the exception of that which is obscene, seditious, or libelous. One of the most famous cases involving freedom of the press was the trial of John Peter Zenger (*q.v.*), which set a precedent regarding freedom of the press in the U.S.

Within recent years Americans have been increasingly concerned with the maintenance of a free press. One of the important analyses in the field was prepared in 1947 by a Commission on the Freedom of the Press, headed by Robert M. Hutchins (*q.v.*). The report concluded a four-year study, reporting that press freedom was in danger unless the press took its public responsibility more seriously. The commission offered a 133-point program for self-improvement of the press. The U.N. Conference on Freedom of Information and of the Press, held at Geneva, Switzerland (1948), proposed a world code on press freedom.

Pressure (*prĕsh'ĕr*), force per unit area. To calculate pressure, the amount of force exerted is divided by the unit area against which it is applied. For example, if a force of 185 lbs. were exerted against a circular area, as would occur if a piston exerted that much force in a cylinder, the amount of pressure would be calculated by dividing 185 by the area of the cylinder. If the cylinder were 4 in. in diameter, its area would be 3.1416×2^2 (the area of a circle is $3.1416 \times$ its radius squared) or 12.5664 sq. in. Dividing this into 185, we obtain approximately 14.7 lbs. per sq. in. In this example, all air was removed from the cylinder by use of a vacuum pump. The piston was driven forward by the weight of only the air above it. This force was measured and found to be 185 lbs. As we calculated above,

we have shown that the pressure of air (at sea level, and under normal conditions) is 14.7 lbs. per sq. in., or 1,012,630 dynes per sq. cm., or 1033.2 grams per sq. cm. This unit is known as "1 atmosphere" and is equal to the pressure exerted by a column of mercury 76 cm. high. This column of mercury 76 cm. high was formerly used by the U.S. Weather Bureau as its standard unit, but by international agreement, the millibar has now been adopted as the standard, so that atmospheric pressure is given in millibars instead of mercury units. The millibar is equal to 100 newtons per sq. m. (The newton is a force unit in the MKS—meter, kilogram, second—system, and represents a force of 1 kg. per meter per second per second.) Normal atmospheric pressure represents about 1,013 millibars.

The barometer is a pressure balance, because the weight or pressure of the air just balances the 76-cm. column of mercury. Air containing water vapor is heavier than dry air and thus it will balance a heavier column of mercury. Air pressure is also measured by the aneroid barometer, which contains a sealed flexible, metal bellows in which is a fixed amount of normal air. When the pressure of the outside air is greater or less than that in the bellows, it contracts or expands, and in so doing moves a pointer on a scale which indicates the varying air pressure. Height, as well as the quantity of water vapor, changes the reading of barometers, because with distance above the earth, the weight or pressure of the atmosphere becomes less. Hence, barometers can be used for determining height above sea level.

Other instruments for measuring the pressure of gases or liquids are manometers, which balance a column of mercury against a column of the fluid or gas being measured. Another type of manometer contains a thin, coiled metal tube, which uncoils according to the amount of pressure in it. This act of uncoiling moves a pointer on a gauge which indicates the pressure of the liquid being measured. When most gauges are open to the air, they usually register "zero." Thus to most gauge readings must be added the atmospheric pressure to obtain the total pressure.

Robert Boyle formulated "Boyle's Law," which deals with the pressure of gases in an enclosed cylinder. He found that to compress a given amount of gas in a cylinder to half its volume, it was necessary to double the pressure, *i.e.*, the pressure of a given mass of gas is inversely proportional to its volume. Charles' law deals with the changes in gas pressure due to temperature. The pressure exerted by a given mass of gas is directly proportional to the temperature. Thus the pressure of gases increases with a rise in temperature. The pressure of a liquid is equal to the height of the column of liquid multiplied by the density of the liquid.

Prester John (*prĕs'tĕr jŏn*), meaning Presbyter or Priest John, a legendary king and priest of the Middle Ages whose kingdom was said to have been located in Asia. He was allegedly converted to Christianity and fought in its behalf against other Asiatic rulers.

Preston (*prĕs'tĕn*), a county borough of England in the County of Lancashire. It is a considerable industrial town, and is the center of local government for the County of Lancashire.

Preston stands on a hill above the estuary of the Ribble River. It has been a borough since the year 1179, when a charter was granted to it. Its position on the main road to Scotland gave it importance in the history of England's many wars with the Scots, who are said to have burned it once at least—in 1322. During the 18th century it was a center for fashionable society, and earned the nickname it still bears, "Proud Preston."

The physical relics of Preston's history were obliterated during the industrialization of the 19th century. However, some of its modern Gothic buildings are impressive. There are seven public parks and playing fields, and a public library, museum, and art gallery.

Preston is on a main railway line connecting Scotland and Northwest England with London, and is a railroad junction for branch lines running east and west. It has long been an important center for the cotton textile industry; the first cotton mill was built there in 1777, and Richard Arkwright, inventor of the spinning jenny, was born there. Preston's present industries include, besides cotton and textile engineering, rayon manufacture, electrical engineering, chemical and soap works, shipbuilding and repairing, and motor manufacture. Preston has extensive docks and quays. Population, *ca.* 115,000.

Pretoria (*prĕ-tŏ'ri-ä*), a city of South Africa, capital of the Transvaal Colony, so named from Marthinus Pretorius, an influential Boer leader. It is on an elevated plain on the southern slope of the Magalies Berge, 35 m. N.E. of Johannesburg. It is connected by railway with Delagoa Bay, Johannesburg, Bloemfontein, Kroonstad, and Port Elizabeth. The country surrounding it is fertile, producing tobacco, wheat, sugar cane, cotton, coffee, indigo, fruits, and vegetables. Among the noteworthy buildings are those erected by the government, numerous churches, several schools, and many fine residences. The city was founded in 1855 and surrendered to the British in 1900. Population, over 125,000 of which *ca.* 45,000 are natives (Bantu).

Prévost (*pră-vŏs'*), EUGÈNE MARCEL, novelist, born in Paris, France, May 1, 1862; died in 1941. After studying in a Jesuit academy and the Polytechnical School, he engaged in manufacturing tobacco. In the meantime he published "Le Scorpion," a story against Jesuit education, and in

1791 he entered the literary field. His writings are numerous and deal largely with educational and social questions. Among his chief works are "Nouvelle lettres de femmes," "Les Demi-vierges," "Sa maitresse et moi," and "L'Homme vierge." In 1799, he was elected to the French Academy.

Prevost (*prě-vô*), SIR GEORGE, soldier, born in New York City, May 9, 1767; died Jan. 5, 1816. He entered the British army in 1783, was made captain, and for some time served in the West Indies. In 1808 he was made governor of Nova Scotia and was promoted to be administrator in Canada in 1811. The following year he succeeded Sir James Craig as Governor-General of British North America, which position he held throughout the War of 1812. In 1813 he undertook an unsuccessful attack upon Sacketts Harbor, N.Y., and the next year made an attempt to reduce Plattsburg, on Lake Champlain, where he was defeated by the Americans under Macomb. The British called him before a court-martial for his lack of enterprise, but he died before a verdict was reached.

Prévost d'Exiles (*pră-vô' dăg-zěl'*), ANTOINE FRANÇOIS, better known as *Abbé Prévost*, novelist, born at Hesdin, France, 1697; died in 1763. At 24, he entered a Benedictine monastery, but left it shortly after to travel and write. Most celebrated of his works was the novel, "Histoire du Chevalier des Grieux et de Manon Lescaut" (1733), which had a marked influence on French literature. It was one of the first modern love stories in which the intensity of the feelings of the main characters, Manon Lescaut and the Chevalier des Grieux, was depicted with all its naturalistic details. It represents a kind of "Of Human Bondage" (Somerset Maugham), of the Rococo period, since des Grieux follows Manon

although he is quite aware of her moral inferiority. The novel provided the motif for two operas, one by Puccini (*q.v.*), and one by Massenet (*q.v.*). He lived in England for several years, returning home to write an eight-volume treatise entitled "Cléveland, ou le Philosophe Anglais" (1731-38), and to translate the novels of Samuel Richardson into French, thus bringing to France a more intimate knowledge of English life.

Priam (*prī'am*), in Greek legends, the King of Troy in the period of the Trojan War. He was the son of Laomedon and originally was named Podarces, but this was changed to Priam, which signifies the ransomed one, because he was saved from imprisonment and death by his sister, Hesione, after having fallen into the hands of Hercules. He married Hecuba, daughter of Dymas, King of Thrace, and among his renowned children were the prophetess Cassandra, the valiant Hector, and Paris, who caused the Trojan War. The city of Troy was under his government at the time of the Trojan War, which was caused by Paris carrying away Helen, but could have been prevented if he had restored her to the Greeks. His capital was destroyed after a siege of 10 years, and he was killed by the hand of Neoptolemus while lying prostrate before the altar of Zeus, praying for divine assistance in the hour of peril. Homer does not mention his death, but it is recounted in the writings of Virgil and Euripides.

Priapus (*prī-ă'pūs*), in classical mythology, a god of the countryside and fertility, connected with phallic worship. He is supposed to have been an ugly god, although the son of Dionysus and Aphrodite. See also *Phallus*.

Pribilof (*prē-bē-lōf'*), or *PRIBYLOV*, a group of islands in the Bering Sea, 200 m. n. of the Aleutian Islands, belonging to the U.S. The group has an area of 170 sq. m. St. George, St. Paul, and Walrus are the largest islands of the group. Dense fogs surround them much of the time. The fur seal herd of the islands, administered by the U.S. Department of Commerce, supplied about 85 per cent of the fur seals of the world before World War II. In June 1942, the U.S. armed forces evacuated the inhabitants to southeastern Alaska. Population, ca. 500.

Price (*prīs*), in economy, a term applied to the value of goods expressed in terms of money. It represents the sum of money for which a prospective seller is willing to transfer his goods to a buyer, or which a prospective purchaser offers for the transfer of the goods to him.

Price, LEONTYNE, operatic soprano, born in Laurel, Miss., in 1927. She studied singing and piano in Laurel and later at the Juilliard School of Music in New York City. She was aided in pursuing her studies by the family of Alexander Chisholm, a Laurel banker, for whom her aunt



ABBÉ PRÉVOST

worked as a maid. After triumphs in European opera, Leontyne Price made her U.S. debut as *Aida* at the Metropolitan Opera, achieving the most spectacular success in its modern history. Among her other roles in the repertoire are *Leonora* in "*Il Trovatore*," *Cio-Cio San* in "*Madama Butterfly*," *Donna Anna* in "*Don Giovanni*," *Liu* in "*Turandot*," and *Minnie* in "*The Girl of the Golden West*."

Price, STERLING, soldier, born in Prince Edward County, Virginia, Sept. 11, 1809; died in St. Louis, Mo., Sept. 29, 1867. Educated at Hampden-Sidney Coll., he later studied law. Moving to Missouri in 1831, he served in the legislature and in 1844 was elected to Congress. He volunteered for the Mexican War and as a brigadier general was responsible for the conquest of Chihuahua, of which he was made military governor in 1847. He served two terms as governor of Missouri (1853-57). At the outbreak of the Civil War, Price joined the Confederacy and fought in the battles of Wilson's Creek, Pea Ridge, and others.

Price Administration (*prīs ād-mīn'is-trā-shūn*), OFFICE OF. See *Price Stabilization*.

Price Agreement (*prīs ā-grē'mēt*), a stipulated sum of money agreed upon in a contract between a seller and a buyer for the transfer of goods, or between an employer and an employee for service. The term usually refers to agreements between competing manufacturers or producers for the purpose of eliminating price rivalry. Such compacts, as well as combinations designed to restrain trade, are theoretically prohibited by anti-trust laws. See *Trusts*.

Price Fluctuations (*prīs flūk-tū-ā'shūnz*), variations in the purchasing power of money, reflected in the changes of the general price level over a designated period of time.

Price Stabilization (*prīs stā'bī-lī-zā'shūn*), OFFICE OF (OPS), a Federal agency established to promote economic stability through control of prices. The OPS came into being as a result of the inflationary pressures generated by the war in Korea in June 1950.

The danger of an inflationary spiral was recognized by Congress when it passed the Defense Production Act of 1950 which authorized the control measures necessary for economic stabilization. The act became law on Sept. 8, 1950, and the next day an executive order was issued establishing the Economic Stabilization Agency (ESA). Michael V. DiSalle became first Director of Price Stabilization, and the OPS was formally established as an operating arm of the ESA on Jan. 24, 1951.

On Jan. 26, 1951, the OPS issued a General Ceiling Price Regulation, freezing prices of most goods and services at the highest level reached during the preceding five weeks. By July 18 prices of 28 basic commodities had dropped more than

16 per cent, contrasted with an advance of more than 47 per cent from June 1950 to February 1951. Wholesale prices declined about 3 per cent by July 17, 1951, after having risen 14.9 per cent during the earlier period. On the conclusion of the Korean conflict, the OPS was terminated by executive order on April 30, 1953.

OFFICE OF PRICE ADMINISTRATION

The Office of Price Administration, created by executive order on April 11, 1941, was established to avoid inflation as the economic pressures of World War II mounted. The success of the program may be measured by the fact that prices increased 31 per cent from the outbreak of the war in Europe until V-J day (1945), as contrasted with a rise of 62 per cent during the four years and four months of World War I. During World War II, 90 per cent of the advance occurred before issuance of the President's "hold the line" order in April 1943.

Upon expiration of the Price Control Act in June 1946, all price controls were suspended. Later in the following month, however, Congress passed an extension act providing for continuation of rent control and of price control in fields where scarcities existed. In November the President directed cessation of all controls except those over sugar, rice, and rents, which were later modified or abolished. In December 1946 the Office of Price Administration was consolidated with other agencies to form the Office of Temporary Controls, which itself was liquidated in several stages in 1947. See also *Consumers' Price Index*.

Prichard (*prīch'ērd*), JAMES COWLES, physician and ethnologist, born in Ross, England, Feb. 11, 1786; died in London, England, Dec. 23, 1848. He studied medicine, modern languages, and history, partly at the London St. Thomas Hospital and partly at Edinburgh, Cambridge, and Oxford. In 1810 he settled as a physician in Bristol, and was soon after appointed physician to the Bristol Infirmary. His first noted publication, "Researches into the Physical History of Man," first appeared in 1813 and went through a number of revisions and translations. He published "The Eastern Origin of the Celtic Nations" in 1831, in which he compared the different dialects of the Celtic with the Teutonic, Sanskrit, and other languages. Other writings include "Analysis of Egyptian Mythology," "Diseases of the Nervous System," "Treatise on Insanity," and "Insanity in Relation to Jurisprudence."

Prickly Ash (*prīk'li āsh*), a shrub or small tree native to North America. The plant is prickly and the smell of the leaves and bark resembles that of lemons. A stimulant useful in treating toothache and rheumatism is made from the bark. Several species are found in the

West Indies and the southern part of the U.S.

Prickly Pear (*prĭk'li pā'r*), a plant native to North America, found along the Atlantic coast of the U.S. and in the Mississippi Valley. The species common between Connecticut and Georgia are sometimes called *Indian fig*. They have a leafless, light-green stem, produce pale yellow flowers, and bear an edible fruit an inch or more in length. The fruit is juicy and has a sweetish but acid taste. The kindred species of the central Mississippi Valley has larger flowers and fruit and a deep green stem. Several species have been introduced in Mediterranean countries and in China. The fruit is used extensively as food. In some countries the plants attain a height of from 5 to 8 ft. and are useful as hedge plants. Several species of cacti, native to Mexico and the southwestern U.S., are also known as *prickly pear*. Several species were improved for cultivation by Burbank; in a wild state they are covered with spines.

Prideaux (*prē-dō'*), JOHN, soldier, born in Devonshire, England, in 1718; died near Ft. Niagara, N.Y., July 19, 1759. Entering the army at an early age, he attained the rank of brigadier general in 1759, when he was given command of a division sent to Canada in the American phase of the Seven Years' War. With Ft. Niagara as his objective, he arrived near there on July 7, 1759, beginning his offensive the same day. On July 19, 1759, he was killed when a shell exploded prematurely. The fort surrendered to his troops five days later.

Priest (*prēst*), a person ordained specifically to offer sacrifice and to perform other related religious functions. The history of the priestly office is nearly identical with that of religion. It is related that Cain and Abel offered their own sacrifices, but the priestly office was established soon after. At first it was vested in the heads of families only, as in the case of Abraham, Isaac, and Jacob, but a special priesthood was established under the Mosaic law, after which the Levites, one of the 12 tribes of Israel, the successors of Levi, furnished the priests and the high priests. Not only in Judaism, but also in various pagan religious systems, in Buddhism (*q.v.*) and Brahmanism (*q.v.*), the idea of a priesthood gained ground. Actually the function of the priest, the religious leader, can be found in all primitive regions from the very beginning of organized forms of human society. It probably preceded even the recognition of a war leader (king). Symbols of priesthood have been found in excavations of the 5th millennium B.C.

The Greek, Armenian, and Roman churches maintain the function and the title of priest, and they look upon ordination to this office as one of the sacraments. In the Roman Catholic Church the priests are bound to celibacy, but the Greek Church and a number of the eastern branches

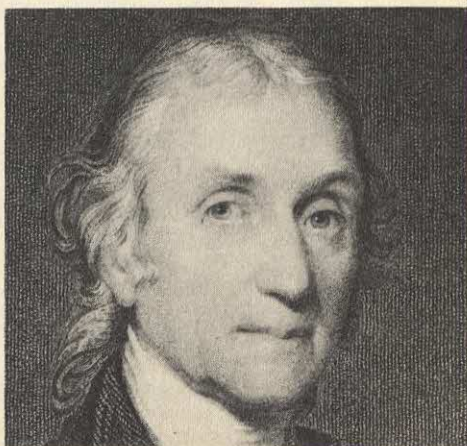
permit the consecration of a married man as priest. Once ordained, however, a priest of the Greek Church may neither marry nor remarry. Priesthood is held to be a nullifying impediment to the reception of the sacrament of matrimony. Protestant churches look upon Christ as the real priest, who is held to be the only one who has the power of offering sacrifices for the people, and they regard the clergy as the teachers and servants of the church. While with the Protestants in general the clergy are divinely called and properly appointed, they are held to possess certain ecclesiastical rights and are to discharge certain duties. They derive these functions partly from divine and partly from human law. The word priest is retained by the Anglican and other Episcopal Churches to denote the second order of clergy, ranking next to the bishops. Some Anglicans have revived the title of priest, and in some places celebrate the Mass, which was banned under pain of death at the accession of Queen Elizabeth (*q.v.*).

Priestley (*prēst'ly*), JOHN BOYNTON, author, born in Bradford, England, Sept. 13, 1789. Priestley was educated at Trinity Hall, Cambridge, and served in World War I. Although he has written volumes of literary criticism, biography, and social commentary, he is probably best known for his plays, such as "Dangerous Corner" (1932), "Time and the Conways" (1937), and "The Long Mirror" (1940), and for his novels, including "The Good Companions" (1929), "Angel Pavement" (1930), "Faraway" (1932), "Rain upon Godshill" (1939), "Black-Out in Gretley" (1942), and "Festival" (1951).

Priestley, JOSEPH, scientist, philosopher, and divine, born near Leeds, England, March 13, 1733; died in Northumberland, Pa., Feb. 6, 1804. He studied Latin and Greek, and later spent three

JOSEPH PRIESTLEY

Courtesy Brown Bros., N. Y.



years at a Dissenter academy at Daventry, London. In 1755 he became minister of a small congregation in Suffolk, and in 1761 was appointed teacher of languages at the Dissenter academy of Warrington. While there he married and commenced his literary career. He formed the acquaintance of Benjamin Franklin, while on a visit at London, who supplied him with a number of books of service in his study and research. His first published work, "The History and Present State of Electricity," appeared in 1767. About the same time he published "Theory of Language and Universal Grammar" and a work entitled "Vision, Light, and Colors." The Univ. of Edinburgh granted him a degree in 1766, and shortly after he became minister of the Mill Hill Chapel at Leeds.

Priestley is generally credited as having been the first to discover oxygen, which he called *dephlogisticated air*, and announced his discovery in his work entitled "Experiments and Observations on Different Branches of Air," which appeared in 1774. Lord Shelburne appointed him librarian and literary companion about that time with a salary of \$750 a year, and he accompanied the earl on a tour of Europe in the latter part of 1774. Later he was chosen minister of a Dissenter congregation at Birmingham and became noted as a writer and speaker in favor of the French Revolution, which so excited public opinion that a mob set his house on fire and caused his library and manuscripts to be destroyed. In his theological writings, he declared the Church to be the intrinsic enemy of truth and based everything on reason and logical conclusions. Actually, he became almost an agnostic, at least a deist (see *Deism*). He was compensated for this outrage, but the award did not cover the loss. Priestley's advanced position upon scientific questions made him unpopular in England and in 1794 he came to the U.S., settling at Northumberland, Pa., where his death occurred. During his 10 years in America he had, however, founded some Unitarian communities and veered gradually more toward a liberal and undogmatic Christianity. Among his writings not already named are "Disquisitions Relating to Matter and Spirit," "Letters to Philosophical Unbelievers," "History of Early Opinions Concerning Christ," "Doctrine of Philosophical Necessity," "General History of the Christian Religion to the Fall of the Western Empire," and "Theory of the Human Mind." While his theological writings are not of great interest to us any longer, since he followed in them only the general trend of contemporary French and English Enlightenment, his importance as a natural scientist cannot be overestimated. His theories were of greatest influence on the natural sciences of his and the following generation and his discovery of oxygen, hydrogen

chloride, ammonia, and many other chemical substances made him one of the foremost chemists of all time. Even Lavoisier (*q.v.*) used some of his ideas for his system.

Prim (*prēm*), JUAN, Spanish soldier and statesman, born in Reus, Spain, Dec. 6, 1814; died Dec. 30, 1870. He was a son of Pablo Prim, a military officer, and at an early age entered the military service. In 1837 he was appointed colonel in the regular army for distinguished services in support of the infant Queen Isabella, and, when the Espartero ministry was overthrown, in 1843, he was made general and created Count of Reus. The democratic rising that followed soon after at Barcelona caused the government to appoint him to restore order, but his dilatory course was the cause of his dismissal. He was accused of being implicated in the assassination of Narvaez, president of the council, in 1844, but his sentence to six years' imprisonment was revoked by the queen the following year.

Prim entered the senate in 1858 and the following year commanded the Spanish reservé in the war against Morocco. In 1861 he secured command of the Spanish contingent and was sent to command the Spanish army in Mexico, but soon withdrew his forces, a course afterward approved by the Cortes of Spain. He led an insurrectionary movement against Queen Isabella in 1866, but its failure required him to flee for safety. However, he continued to direct the movement of the insurgents from Brussels until Queen Isabella was overthrown in 1868, and soon after he became dictator of Spain. He offered the Spanish crown to Prince Leopold of Hohenzollern in 1870. When Leopold declined the proffered throne of Spain, Prim induced the Italian prince, Amadeus, to accept it. Prim was wounded by an assassin on the day Amadeus landed in Spain and died two days later.

Primary Election (*prī'mā-rĭ ē-lĕk'shūn*), elections in the various states of the U.S. to nominate candidates or to select delegates to the party conventions which nominate electoral candidates. It was introduced to supplant the political convention system which had proved cumbersome and subject to the abuses of professional politicians. For Presidential nominations, primary elections are usually held in March, April, May, or June, as prescribed by state law or party usage.

The *direct primary elections* originated in Pennsylvania in 1868, but the first official primaries were adopted by the Wisconsin legislature in 1903. By 1917, 46 states and the territories had adopted laws providing for primary elections, the rest selecting delegates at state conventions. Direct primaries are of two types, *open* and *closed*. The open primary allows the voter to select the delegates of any party he chooses, irrespective of party affiliation, while the closed primary permits only

enrolled supporters of a given party to select delegates of that party. Only a few states have open primaries. See also *Election*.

Primates (*prī-mā'tēz*), the highest order of mammals. Primates include man, the great apes (e.g., gibbon, orangutan, chimpanzee, and gorilla), the Old World monkeys (e.g., baboon, rhesus monkey), the New World monkeys (e.g., *Cebus*, the organ grinders' monkey, the spider monkey, the howler, and all monkeys with prehensile tails), and the lemurs (nocturnal, with enormous eyes, the most primitive of the Primates). With the exception of man, Primates live chiefly in tropical and subtropical lands. Opposable digits, which make grasping possible, with flat nails on the five digits of fore and hind limbs, collarbone and caecum, and an upright walk are common features of Primates. Except in some lemurs, the eyes are frontally placed, making binocular vision possible; the breasts are a single pair placed as in man except for a few species which also have a single pair in the groin, functional only in lemurs. A high order of intelligence is the outstanding characteristic of most higher Primates, although many of the lemurs are less intelligent than certain species of other orders (e.g., elephants, dogs). The principal groups of Primates, although belonging to entirely separate family branches, began their separate descents from a common, less specialized ancestor, such as an insectivorous animal (e.g., shrew, mole) in the Eocene period, beginning about 60,000,000 years ago.

Prime, SAMUEL IRENAEUS, clergyman and editor, born in Ballston, N.Y., Nov. 4, 1812; died at Manchester, Vt., July 18, 1885. He was graduated from Williams Coll. in 1829, studied theology at Princeton, and in 1833 was called to the Presbyterian ministry. In 1840 he was required to discontinue pastoral work because of feeble health, and from that time until his death he edited the New York *Observer*. He traveled in Europe several years and became famous for his "Irenaeus Letters." In the meantime he contributed many articles to *Harper's Magazine*. Among his other works are "Travels in Europe and the East," "The Power of Prayer," and "The Old White Meeting House."

Prime Mover (*prīm mōōv'ēr*), an ultimate source of mechanical energy, usually a heat engine which converts heat energy into mechanical energy; or a hydraulic turbine or motor which converts the movement of fluids into mechanical energy. See also *Hydraulic Turbine*; *Internal-Combustion Engine*; *Steam Engine*; *Steam Turbine*.

Prime Number (*nūm'bēr*), a term in mathematics. See *Numbers*.

Primitive Art (*prīm'i-tīv ārt*), the work of self-taught artists who have not received a formal art education. Such folk artists were widely found

in earlier centuries; they painted tavern signs, for instance, decorated houses and furniture, made weather vanes and sundials. Through plain intuition they created excellent work; however, neither they nor the beholder took exception to shortcomings in perspective, proportions, or coloring. In the U.S. the so-called folk art of the Pennsylvania Dutch or of the Spanish-Mexican artists affords examples of primitive art. Some of the works are so good that they have become precious museum pieces.



Collection of Museum of Modern Art, gift of Mrs. John D. Rockefeller, Jr.

PRIMITIVE ART

"The Dream" (1910)

Oil painting by Henri Rousseau (1844-1910)

At the beginning of the 20th century, in France and also in the U.S., some primitive artists appeared whose works are today evaluated as among the best paintings of this period. Henri Rousseau (q.v.), *le douanier*, is especially famous for his fairy-tale images and French scenes, notwithstanding that he depicted them purely from imagination. Pierre Bombois (1883-), another Frenchman, excelled especially in circus scenes. In the U.S. Joseph Pickett (1848-1918), John Kane (1860-1934), Anna Mary Robertson Moses (1860-1961), known as "Grandma Moses," and Morris Hirshfield (1872-), have been notable in the field.

Primo de Rivera y Orbaneja (*prē'mō THā-rē-vā'rā ē ór-bā-nē'hū*), MIGUEL, MARQUIS DE ESTELLA, soldier, born in Cadiz, Spain, in 1870; died in Paris, 1930. He served in Cuba and the Philippines during the Spanish-American War (1898) and later in Morocco (1909-13); was appointed military governor of Cadiz (1915-17), and of Barcelona (1922). In September 1923, he led a bloodless revolution, overthrew the government, and became dictator of Spain. His government, based upon martial law, was abolished in 1925, but he retained his dictatorial powers as nominal premier. He led the Spanish forces in a Moroccan campaign against Abd-el-Krim (1924-26), and with the help of the French forced the Moorish leader to surrender in 1926. Although the king and military leaders had supported him during the first

years of his regime, they eventually turned against him and forced his resignation in 1930.

Primogeniture (*pri-mô-jên'tî-tûr*), in law, the rule which confers a title or estate on a person by virtue of his being the eldest male of those who could inherit. It was recognized in many of the ancient systems of law, but the custom has been discarded to a large extent. Up to the time of the Norman Conquest all sons inherited alike, but at that time primogeniture was established, although it was modified from time to time until it finally disappeared. As a system it operates to pass the title in all the real estate of the father to the eldest son. However, if there are no male heirs, then the daughters inherit jointly, except in the case of the crown, which becomes vested in the eldest daughter.

Primrose (*prim'roz*), any one of about 400 plants of the genus *Primula* in the primrose family. The plants are herbaceous perennials, native to the northern temperate regions, and bloom in spring and early summer. They may be cultivated in gardens or greenhouses. In all species the leaves grow in a rosette at the ground; the flowers, whose color depends on the species, grow in clusters on erect, bare stems. The common English primrose (*P. veris*) is also called the cowslip (*q.v.*).

The evening primroses are those plants of the genus *Oenothera* which have flowers opening in the evening and closing in the morning. In the evening primrose family, the plants are native to the temperate Western Hemisphere. The flowers have four showy, usually yellow, petals. Other cultivated plants commonly called primrose include the Arabian primrose (*Arnebia cornuta*), the Cape primrose (genus *Streptocarpus*), and the water primrose (genus *Jussiaea*).

Prince (*prîns*), the title applied to one who possesses royal honor or power, as the sovereign of a country. The term is used also in speaking of the sons of sovereign rulers, and the title of *princess* is applied to the daughters. In some countries a territorial addition is made to the title, as Prince of Orange, Prince of Wales, and Prince of Naples. Many members of ancient families in Europe bear the title of prince, though they are not immediately connected with a reigning house, but in England the term is applied only to members of the royal family. *Prince consort* is the title of the husband of a reigning queen.

Prince Albert (*âl'bért*), a city of Saskatchewan, about 200 m. N.W. of Regina, on the North Saskatchewan River and on the Canadian National R.R. It has lumber and flour mills, brick-yards, elevators, fishing and fur trading, and much shipping. It was incorporated in 1885. Population, ca. 15,000.

Prince Edward Island (*êd'wêrd î'land*), a province of the Dominion of Canada, situated in

the southern part of the Gulf of St. Lawrence. It comprises all of Prince Edward Island, which is separated from Nova Scotia and New Brunswick by Northumberland Strait. The length from southeast to northwest is 130 m. and the width ranges from 4 to 35 m. The area is 2,184 sq. m., making this province the smallest member of the Dominion.

DESCRIPTION. The coast line is remarkably irregular, being indented by many gulfs, bays, and inlets. Cardigan Bay, on the eastern coast, and many others, afford deep and spacious anchorage for large vessels. Most of the coasts are of red sandstone, sloping gently down to smooth sandy beaches, and the soil is made up largely of a loose, rich, sandy loam.

The streams, influenced considerably by the tides, have wide estuaries as they enter the sea. The summers are pleasant and the winters are less severe than in Nova Scotia. Fine forests of hemlock, cedar, fir, spruce, pine, and hardwood formerly covered the island, but the timber area has been greatly reduced.

INDUSTRIES. Agriculture is the principal industry and fully two-thirds of the area is utilized for farming and grazing. Oats, hay, wheat, potatoes, and turnips are the leading crops, but barley, rye, buckwheat, and garden vegetables are grown profitably. Dairy farming has been developed as an important enterprise. Cattle and horses are raised profitably and the breeds grown are of a high class. Other domestic animals include sheep, hogs, and poultry.

Fishing ranks second among the occupations. The catches include lobsters, hake, herring, cod, oysters, and mackerel. Oyster dredging is followed extensively. The fisheries yield products for canning and curing and in this form large quantities are exported. Other manufactures include butter, cheese, machinery, and lumber products. Building stone and clays are found in paying quantities. Silver, platinum, and other types of foxes are raised in captivity for their pelts.

Communication is provided by a railway that extends the entire length of the island and which is linked up with mainland systems by a ferry. The lines were built and are still owned and operated by the Canadian government. Good highways are maintained in all parts of the island. Steamboat communication extends to the leading ports in Canada and the U.S.

GOVERNMENT. The form of government is similar to that of the other provinces in the Dominion. Chief executive power is vested in a lieutenant governor, who is appointed by the governor general of Canada, and is assisted by a council of eight members. The legislative assembly has but a single chamber, half of whose 30 members are elected by a popular vote, the remainder by real property holders. All serve five-

year terms. The judicial department comprises an admiralty district court, a superior court, and several minor courts. For the purpose of local government it is divided into the three counties of Prince, Kings, and Queens.

A free school system was established in 1851. The schools are undenominational and are administered by a director and a council appointed by the government. They are supported partly by funds derived from government grants and partly by direct taxation. There are about 500 schools, 700 teachers, and 18,000 pupils.

POPULATION. Most of the inhabitants are of British origin. The Anglicans, Presbyterians, United Churchmen, Baptists, and Roman Catholics are well represented in the province. Charlottetown, with 14,821 people, on Hillsborough inlet, is the capital and largest city. The principal towns include Summerside, Georgetown, and Alberton. Population, 1901, 103,259; in 1931, 88,040; in 1941, 95,047; in 1951, 98,429.

HISTORY. Prince Edward Island was discovered by Sebastian Cabot in 1497 and was claimed by Champlain for France in the early part of the 17th century. The Count of St. Pierre secured a grant of it in 1719 and made an unsuccessful attempt to found colonies. It was seized by the British in 1745, but was restored to France by the Treaty of Aix-la-Chapelle. It was finally annexed by Great Britain and placed under the administration of Nova Scotia in 1758, but soon after a separate government was established for it. Canadian confederation was decided upon in 1864 at a conference held in Charlottetown, which resulted in the establishment of the Dominion in 1867, but Prince Edward Island did not enter the confederation until 1873. By 1875, the large landed proprietors were forced to sell their holdings. Depopulation, largely through emigration to the U.S., reached its peak about 1910. With the development of modern highways, the province has become attractive to tourists.

Prince of Wales (*wālz*), the title conferred upon the heir apparent to the throne of Great Britain, originally borne by the sovereigns of Wales. It was first conferred to please the Welsh at the time of the conquest of Wales, in 1284, by Edward I, on his son, later Edward II. Since Edward III conferred the title upon his son, Edward the Black Prince, in 1343, it has been borne by the sovereign's eldest son. The title is bestowed by individual investment and is accompanied by the earldom of Chester, but the eldest son is by inheritance Duke of Cornwall, a title first conferred by John of Eltham, the last Earl of Cornwall, on Edward the Black Prince, in 1337. The Prince of Wales as heir to the crown of Scotland also bears the titles of Earl of Carrick, Duke of Rothesay, Lord of the Isles, Baron of Renfrew, and Prince and High Steward of Scotland.

Prince Rupert (*rōō'pērt*), a seaport of Canada, in British Columbia, the Pacific terminus of the Canadian National Ry., about 500 m. n.w. of Vancouver. It is surrounded by farming country, rich also in lumber and fisheries. It has large docks, extensive grain elevators, and a cellulose plant at Prince Edward, 9 m. from Prince Rupert. Population, ca. 8,000.

Princeton (*prins'tūn*), county seat of Gibson County, Ind., 26 m. n. of Evansville. It is on the Southern and the Chicago & Eastern Illinois R.R.'s. Farming, oil, and soft-coal mining are the chief industries. It was settled in 1804 and incorporated in 1838. Population, 1950, 7,673.

Princeton, a borough of Mercer County, N.J., 45 m. n.e. of Philadelphia, Pa., on the Pennsylvania R.R. It is noted as the seat of Princeton Univ., Princeton Theological Seminary, Rockefeller Inst. for Medical Research, and the Inst. for Advanced Study. In 1777 Washington defeated the British forces at Princeton, and the Continental Congress held its session there in 1783. The place was settled in 1681 and incorporated in 1813. Population, 1950, 12,230.

Princeton, **BATTLE OF**, an engagement of the Revolutionary War, fought near Trenton, N.J., between the Americans under Washington and the British under Cornwallis. On Jan. 2, 1777, after the Battle of Trenton, the Americans were confronted by about 8,000 British. Washington, faced by a superior force, resorted to strategy. Leaving a small force to keep the campfires burning and to make a noise, he moved most of his army around the British left and encountered their reinforcements at Princeton on Jan. 3. By cutting the British lines in this manner, he forced Cornwallis to retreat to New York, thus giving the Americans a clear field between Philadelphia and the Hudson. The Americans lost about 100, while the British loss was 200 killed and 300 prisoners.

Princeton University, formerly the Coll. of New Jersey, an educational institution for men, at Princeton, N.J. Though nonsectarian, it is historically allied with the Presbyterian denomination. It was founded in 1746 with the view of providing means for the intellectual and religious culture of those desiring a liberal education, but more especially for the training of candidates for the ministry. The institution was opened at Elizabeth in 1747 under the presidency of John Dickinson, who was succeeded on his death in the same year by the Rev. Aaron Burr. From 1748 to 1756 it was in Newark; it was then removed to Princeton, and Nassau Hall was erected and named in honor of William III. The Presbyterians united to support the college in 1766 and in 1812 established the Princeton Theological Seminary, an institution unconnected with the university. Nassau Hall is the oldest building

and is historic for having been used as a barracks and hospital by the Americans and British at different times during the Revolutionary War. In the Battle of Princeton, on Jan. 3, 1777, a cannon ball passed through the walls, and in 1783 it was the meeting place of the Continental Congress. The latest addition to the university is the Harvey S. Firestone Memorial Library, built at a cost of \$6,000,000, and opened in 1948.

The second president of the college was the father of Aaron Burr, afterward Vice President of the U.S., and other noted presidents include Jonathan Edwards, James McCosh, and Woodrow Wilson. During the presidency of Dr. McCosh the institution reached its present importance, since it received endowments of over \$1,000,000 during his 20-year incumbency. Within this period the departments of language and literature, philosophy, mathematics, and science were established on a firm basis. John C. Green, in 1873, made a liberal endowment to establish the departments of civil engineering, general science, and electrical engineering. Princeton graduates include some of the most eminent men of America, among them James Madison and Woodrow Wilson, Presidents of the U.S.; Henry Fairfield Osborn, Booth Tarkington, Henry van Dyke, Aaron Burr, George H. Boker, Richard Stockton, and Philip Freneau. Normal enrollment is about 3,500, and the faculty about 520. The university has an endowment of approximately \$46,000,000. Its periodicals include *The Annals of Mathematics* and *The Public Opinion Quarterly*.

See also *Institute for Advanced Study*.

Principe (*prĕn'chĕ-pā*), *IL*, Italian, meaning the prince, title of a fundamental work by the Italian statesman Niccolò Machiavelli (*q.v.*), finished in 1513. This famous treatise deals with the basic principles of governing a state and the training and policy of a despotic sovereign.

Principe and San (or **São**) **Tomé Islands** (*prĕn'sĕ-pĕ and sãn tō-mă'*), Portuguese colonies *ca.* 125 m. off the west coast of Africa, in the Gulf of Guinea. The total area of the two islands is 372 sq. m. Cacao, coconut and copra, palm oil, and cinchona are the chief products. There is a 10-m. railway on San Tomé. The two islands constitute a province, administered by a governor. Population, 1940, *ca.* 60,000.

Printing (*print'ing*), the art of producing impressions on paper with ink. These impressions may consist of inked printing types or designs or photographic prints previously cast, drawn, or engraved on a solid surface.

The general methods used in printing are: (1) from *raised* letters, known as *letter-press* printing, and utilizing individual or slug-cast letter type, plates, or engravings; (2) from *sunken* letters or designs (*intaglio*), as in steel-die, cop-plate engraving, or gravure, where the cut-out

letters or designs are filled with ink; (3) from *plane surface*, known as *lithography*, where a flat stone or metal surface receives the letters or designs and is then dampened and inked with rollers, the ink adhering to the letters or designs.

The first method (letter-press) is the means by which most of our reading matter and commercial printing is produced. Printing plants are generally equipped with *Linotype* (or slug-casting) machines to cast entire lines of type, or *Monotype* machines to cast and set single types. Type is cast in various body sizes based on the point system of 72 points to the inch.

The advent of printing, often called man's most important and far-reaching invention, was preceded by more limited means of communication, *i.e.*, the spoken word, picture-writing, the written word. However, the advance of civilization, the need for reading matter more quickly and easily produced, and the desire to perpetuate human knowledge and progress, all fostered, and, in turn, benefited from the development of printing.

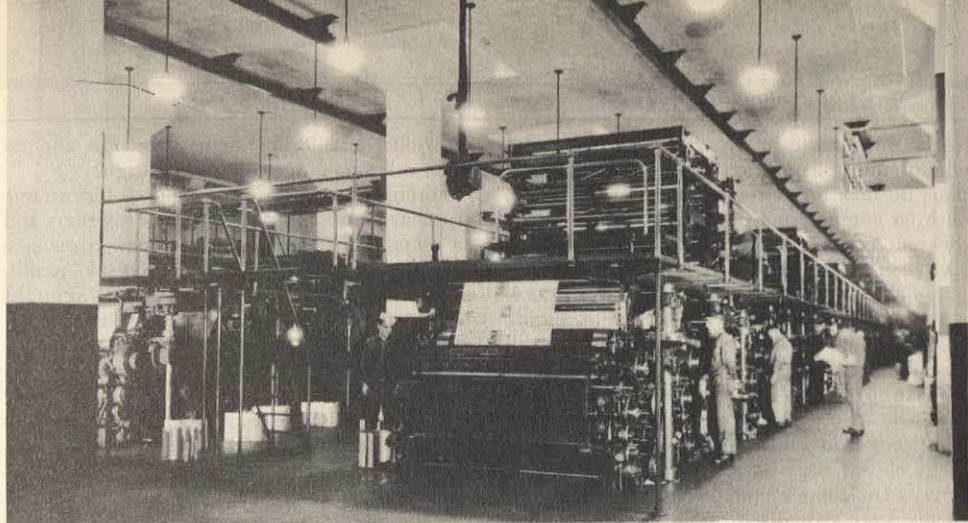
As early as 50 B.C. Chinese classics were being printed from engraved stone tablets or blocks, and movable type is said to have existed in China in the 11th and the 12th centuries A.D.

The exact origin of typography, nevertheless, is a much-disputed question, the inventor being claimed by many nations. Most historians agree that Johannes Gutenberg of Mainz, Germany, and Laurens Janszoon Coster of Haarlem, Holland, are the first authentic founders of movable type. About 1440, Gutenberg discovered that separate letters, or types, could be readily cut from wood; later similar types, of lead, were cast in molds.

The earliest printing press in England belonged to William Caxton whose printing office near Westminster Abbey, London, was established in 1477. During the 16th century the new invention of typography spread throughout civilized Europe, and famous printing houses came into being, including those of Elzevir of Holland, Stephen (Étienne) of Paris, and Christopher Plantin and his descendants of Antwerp, Belgium. The latter plant is now preserved by the Belgian government after almost four centuries of continuous operation.

Harvard Coll., at Cambridge, Mass., holds the distinction of setting up the first American printing press (1639), under the direction of Stephen Daye. Since that time many Americans, including Samuel Rust, David Bruce, Jr., Richard M. Hoe, Ottmar Mergenthaler, Tolbert Lanston, Henry Barth, and countless others, have done much to advance printing, changing it from a small hand art to a vast machine industry ranking fifth in the nation.

The numerous phases of printing which convert a piece of "copy" into printed material, en-



N. Y. Daily News Photo

PRINTING PRESSES OF A METROPOLITAN NEWSPAPER

list an amazingly wide diversity of skills and workers. These include specialists in the various printing processes, some of which are proofreading, typesetting or composing (hand or machine operators), photo-engraving, make-up, electrotyping, stereotyping, binding, etc.

Until about 1800 printing presses were crude hand devices made of wood; today they are intricate, rapid machines of various constructions. These range from the *platen* or *job* press, the *cylinder* press, the *rotary* (web) press and *multi-color* presses to *offset* and *rotogravure* presses. In every case printing results from the impression of two surfaces against each other.

The job printing machine or *platen* press dates from about 1850; it is now generally run by electric power and automatically fed; it operates by means of a platen pressing the paper against the flat surface that bears the roller-inked type form.

Cylinder presses print by the contact of rotating cylindrical surfaces carrying the paper against the flat surface of the type form or electroform. Variations include the single-revolution drum cylinder, the two-revolution cylinder, the stop cylinder, the perfection cylinder, and the two-color cylinder press.

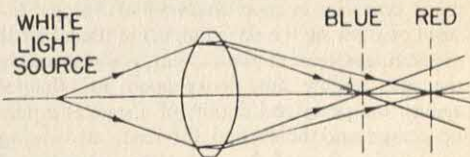
In the *rotary* press, printing is the resulting impression on paper passed between two cylindrical surfaces, one a tympan or impression surface, the other a plate-carrying surface. Curved electrotypes or stereotypes are employed. In one operation the web rotary press prints *both* sides of the paper, automatically fed from a roll or web. Sheet-fed rotary presses print on *one* side of single sheets at each impression. Many improvements and additions have made the web type of machine a favorite for newspapers and magazines. The rotogravure process also uses a rotary press; its high-speed printing of illustrated supplements for newspapers has made it invaluable.

Another 20th-century addition to the printing trade is the offset process, allied to lithography. In offset a rubber blanket receives the impression from a metal plate; then it is "offset" or transferred in turn to the paper.

Modern printing all over the world embodies many of the ideas and devices developed in recent years in the U.S. The "art preservative of all arts" is today more than an art; it is a modern business and a huge industry, recording and spreading civilization. See also *Color Printing*; color plate, *Communication II*, in Volume II.

Prior (*prī'ēr*), in the Roman Catholic Church, the head of a priory, who ranks somewhat lower than an abbot, or the first subordinate of an abbot in an abbey.

Prism (*prīz'm*), a solid whose lateral faces are parallelograms and whose ends or bases form similar, equal, and parallel plane figures. The term is applied in optics to an instrument made of some transparent substance, as quartz, glass, or a prismatic glass case filled with transparent liquid. Such an instrument is usually of a form having equal and parallel triangular ends and whose three sides are bounded by three parallel lines, extending from the three angles of one end



Courtesy Bausch & Lomb Optical Co., Rochester, N. Y.

PRISMATIC ACTION OF A LENS

Schematic diagram showing the difference in focal points for the red and blue rays due to the prismatic action of the lens

to the three angles of the other end. A ray of white light is bent twice from its course in the same direction in passing through such a prism, once on entering and once on leaving, and the different colors are separated so as to form a spectrum. An *achromatic lens* is one that transmits light without separating it into its constituent colors. Light may be achromatized by joining prisms or other refracting bodies which have opposite dispersing power.

Prisoners of War (*priz'-n-ērz of war*), persons who are captured from the enemy in time of war, whether in military or naval operations. Prisoners of war were anciently treated with great severity and those captured from the vanquished enemy were recognized as the property of the victors, who either reduced them to slavery or put them to torture and death. The practice of putting to death nonparticipants came into disrepute with the advance of civilization, but for many centuries all those claiming allegiance to the enemy were reduced to serfdom or slavery, and were either employed by the successful nation or sold into bondage to friendly states. It was the common practice in Greece for centuries to destroy the adult male population of the enemy and enslave the women and children. In the early part of the 13th century A.D. more humane treatment of prisoners of war became general, and the exchange of prisoners was established as a common custom. Prisoners are kept in safe confinement until peace is concluded, unless either exchanged for prisoners taken by the opposite army or navy, or given liberty on parole. Many instances are on record in which modern prisoners of war have been treated contrary to international convention; in Germany and Japan especially, many prisoners were killed during World War II. See also *Red Cross*.

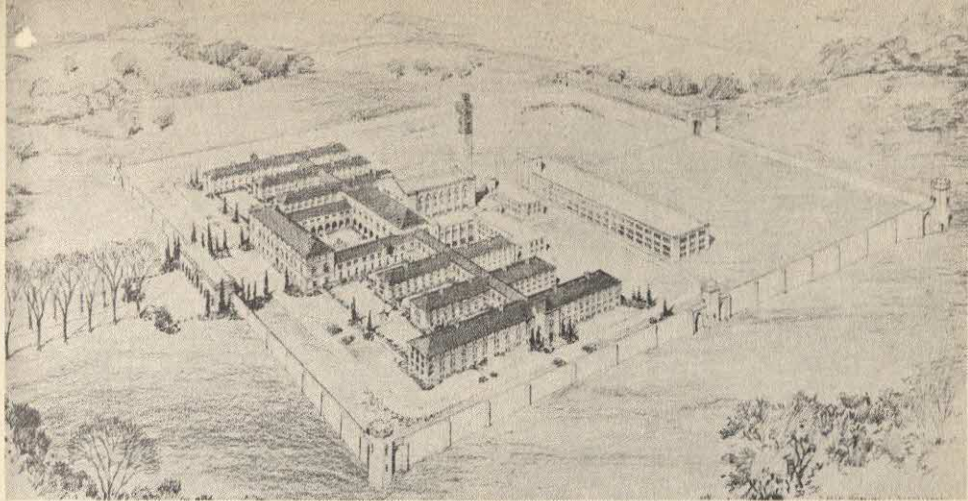
Prisons (*priz'-nz*), institutions constructed and maintained by Federal, State, or local governments as places of confinement for the safe keeping of persons in legal custody. The prison system may be said to be a result of modern civilization, since it has followed in its completeness the abolition of slavery and the feudal system prevalent for many centuries in most countries of Europe. Instead of allowing the slave masters or feudal lords to institute systems of punishment, as was formerly the case, society now looks upon an offender against the peace and dignity of a state as a public charge and holds him for trial; after being tried and sentenced, he is sent to a correctional institution. The punishment is normally not designed to cause the prisoner to suffer physically or mentally; all civilized nations now tax themselves to provide prison systems that shall be rehabilitative in character, not only separating the offender from the public as a benefit to the public, but also for the purpose of retraining the

individual and leading him to become and remain a law-abiding and useful citizen.

In some countries death is inflicted for extreme criminal conduct, but many leading writers and students are beginning to look upon crime as a social rather than an individual problem. According to this view, criminality is largely a result of environment, and it is therefore the duty of society to reform as well as to punish offenders. That these efforts have not been wholly successful is evidenced by the fact that approximately 50 per cent of all prisoners have served previous sentences. Inspired by modern penologists, many reforms are being effected in the treatment of prisoners and the construction of houses of confinement. However, in nearly all jails and in many prisons much imperfection still exists. Many of these institutions are not only poorly constructed, but their management is open to criticism. Modern correctional facilities of this kind are constructed and organized to allow for separation and specialized handling of such categories of inmates as adult first offenders, adult incorrigibles, youthful first offenders, juveniles, women, drug addicts, inebriates, defective delinquents, and misdemeanants.

Progress in reforming prison practice may be said to date from the early part of the 18th century, though in some countries dark dungeons were maintained long after that, in which prisoners were confined under the most objectionable circumstances. In some cases the prisoners perished after a short period of confinement. Since most criminals were formerly banished, mutilated, or put to death, prisons served only as temporary places of detention. With the diversification of economic life in the 18th century, petty crime increased and it became obvious that the prevailing punishments were too severe. John Howard's exposure of English jails, in 1773, created extensive public pressure for prison reform. The cost of humane treatment, however, caused the authorities, in many cases, to cling to the economical punishments of the whipping post, pillory, and branding iron.

Spurred by the humanitarian spirit of the late 18th century, prison reformers continued to expose conditions, and in 1791 the British Parliament passed the general prison act which inaugurated the penitentiary system. At about the same time this movement began to gain ground in America, and especially in Philadelphia. The principle of productive, community work for prisoners was instituted, but inadequate appropriations and political corruptions retarded the progress of corrective prisons. In the early part of the 19th century many of the states followed Pennsylvania in abolishing capital punishment, except for murder in the first degree. In 1829 the penitentiary at Philadelphia adopted the so-called *Penn-*



FEDERAL PENITENTIARY AT LEWISBURG, PA.

Built in 1932, Lewisburg reflects the modern trends in prison architecture

sylvania System, under which prisoners were permanently secluded from each other. This was superseded by the *Auburn System*, under which convicts were separated at night and required to labor in silence by day. This "silent system" was also discarded as society developed toward an understanding of the causes and cures of crime.

In 1825 the first institution for juveniles was established under private auspices in New York. Ohio established the first state training school for boys in 1858 at Lancaster. Massachusetts was the first state to provide separate places of detention for juveniles, founding a school for girls in 1859 at a community also called Lancaster. These institutions are now generally called *training schools* and are maintained in most of the states. Those confined there are taught the common school subjects and various industrial pursuits.

The chief occupations in which adult prisoners are employed include making brooms, furniture, utensils, twine, boots and shoes, clothing and farming implements. In some counties prisoners are employed in mining, carpentering, building roads and highways, and constructing various other public improvements. In some states the prisoners were leased to those bidding highest for their labor, but this system has practically disappeared. The objections of free labor and industry to prison competition led to the passage of the Hawes-Cooper Act in 1929, the Ashurst-Sumners Act in 1935, and the Act of Oct. 14, 1940 which banned prison goods from interstate commerce and effectively ended private contracting for prison labor. Most states now require that prison-made goods be used only in tax-supported institutions.

Other relatively recent innovations are the *parole* and *probation* systems. *Probation* is a term used to describe a means of treating persons convicted of crime. Under this method, the court returns them to the community under supervision

instead of committing them to correctional institutions. *Parole* is applied to a system through which offenders return to civilian life under supervision and guidance, for part of the sentence imposed.

In the 1950's, prison populations rose appreciably, after a marked drop during World War II. In 1940, before the war, there were 175,572 persons in state and Federal prisons; in 1943, 138,710. In 1947, the figure had risen to 141,404, and in 1959 to 205,643. During the 1950's, another matter of concern to penologists was the rise in prison riots, which occurred in many states and involved considerable loss of life, both of prisoners and prison authorities.

Remedial efforts in most states include employment of staffs of social workers, psychologists, and vocational teachers to work with the segments of the population who are most affected by social upheaval. See also *Penology*.

Privateer (*pri-vā-tēr'*), a vessel owned and officered by private individuals, and licensed by letters of marque to carry on maritime war against the commerce and ships of an enemy. More than 400 privateers were fitted out by the British colonies to ravage the commerce of France in the colonial wars of America, and these inflicted great damage along the coast of the French possessions in Canada, in the West Indies, and on the coast of France. The Continental Congress authorized privateers in 1776, and before the end of that year they captured 342 British vessels. Since the owners and crews of privateers were given a large share of the prize property lawfully captured by their vessels, many sailors were attracted to the privateer service throughout the Revolution. In 1778 an American privateer captured the British fort of New Providence, in the Bahamas, and a 16-gun man-of-war. More than 500 British vessels were captured by American

privateers in the War of 1812, and the service became so well organized that immense damage was done to the British on the coasts of the West Indies, the Canary Islands, and even Great Britain. In 1856 the great powers of Europe united in the Declaration of Paris, whereby it was mutually agreed that privateers should no longer be licensed, but the U.S. and several other nations have never accepted the treaty.

Privet (*prī'vĕt*), an ornamental, bushy shrub native to Europe, but naturalized in some sections of North America. The several species include some that are evergreen or nearly evergreen. Several species are used for hedges. They have opposite, entire leaves and small white flowers with a pleasant odor, and yield a small, globular berry, mostly black, but sometimes yellow or greenish in color. The wood is of value for making shoemakers' pegs and for turners' products, while the berries yield dyes and are of service as bird food.

Privy Council (*prīv'y koun'sīl*), the council of the sovereign of Great Britain. It is constituted of persons nominated by the crown at will, and of others on account of their rank or position. The Privy Council originated in the Norman period, but since the duties of government were assumed by the Cabinet its political importance has been greatly diminished. Among the members of the Privy Council are the Prime Minister, the members of the Cabinet, the archbishops, the Bishop of London, the Lord Chancellor and chief judges, the Commander-in-Chief, the great officers of state, the speaker of the House of Commons, and numerous dignitaries who are or were in responsible offices under the crown. The crown is limited in making nominations for the Privy Council to native-born subjects, but no patent or grant is necessary. The Lord President of the Council is its legal head, and the debates and reports from the Council to the crown are under his direction. At present the Privy Council is rarely consulted, since its offices have been superseded largely by the Cabinet.

Privy Seal (*sēl*), the minor seal appended by the sovereign of Great Britain to certain documents, which are afterward authenticated by the great seal. It was used as early as the reign of Edward III, and for centuries was affixed by the authority of the Lord Chancellor. In 1884 an act was passed that all instruments to receive the great seal need only to be countersigned by the Lord Chancellor, Secretary of State, or a high official of the treasury. The privy seal is in the care of an officer called the *lord privy seal*, who now ranks as fifth great officer of the state, and is usually a member of the Cabinet.

Prize Fighting (*prīz' fī'ing*), the game of fighting for a wager, prize, or reward. This game formerly was fought with bare fists, when it was

exceedingly brutal, but at present the fighters are required to wear padded gloves. Both the Greeks and Romans were fond of prize fighting; the Romans introduced these contests to Western Europe, and it still is one of the most popular games, especially in the U.S. Prize-fighters, or pugilists, fight for a specified number of rounds, unless one withdraws or is disabled. See *Boxing*; *Knock-Out*.

Proa (*prō'ā*), a sailing boat about 30 ft. long and 3 ft. wide, used extensively by the natives of the Ladrone Islands and other islands of the Malay Archipelago. It is built with a stem and stern of similar structure, and may be sailed equally well in either direction. One side is flat, on a line from the stem to the stern, while the other side resembles an ordinary boat. The vessel is prevented from tipping by a frame extending to leeward, and in some boats the outrigger extends to both sides.

Probability (*prōb'ā-bīl'i-tī*), a branch of mathematics concerned with predicting the chance that an event will happen or fail.

A gambler sought the advice of the mathematician Blaise Pascal (*q.v.*) concerning the probability that a player, at any stage of a game of chance, would win the game. Pascal became interested in this problem and corresponded with another mathematician, Pierre de Fermat (1601-65), about it. Thus the theory of probability is said to have originated. See also *Logic*.

When two boys toss a coin to decide which one is to have the first turn in a game, they presume that the chance that one will win the toss is just as great as the chance that the other will win. They may know this from many previous experiences in tossing coins, or they may believe it since the coin has two sides and, so far as they can tell by inspection of the coin, one side is just as likely to turn up as the other side.

On examination of a coin, we see that, in addition to its two sides, the edge is very thin, and the weight of the coin seems to be equally distributed. Thus we conclude that, if a coin is tossed, it will fall either heads up or tails up and, so far as we can tell, heads are just as likely to occur as tails. In this case we say that the probability for a head, or for a tail, on any toss of the coin is 1 to 2 or $\frac{1}{2}$.

In a similar manner when we examine a die (one of two dice), we note that it is a perfect cube having six faces, each with a different number marked on it, and having its weight distributed uniformly through the die. Thus again we conclude that, if the die is rolled, one of the six faces will be uppermost when it comes to rest and, so far as we can tell, any one of the faces is just as likely to be uppermost as any other. In this case we say that the probability for a two, or for a three, or for any other number on the die, on any roll of the die, is 1 to 6 or $\frac{1}{6}$.

The probability found in the examples in these two paragraphs above is called a *a priori probability*. In each case it is assumed that all the ways in which the event can happen or fail are equally likely. Calling the total number of equally likely ways in which the event can happen or fail the "possible cases," the number of ways in which the event can happen the favorable cases, and the number of ways in which the event can fail the "unfavorable cases," we can define the *a priori* probability as follows: The probability for the success of an event is the ratio of the number of favorable cases to the total number of possible cases. Similarly, the probability for the failure of an event is the ratio of the number of unfavorable cases to the total number of possible cases. If the probability for success be denoted by p , probability for failure by q , the total number of possible cases by n , the number of favorable cases by f , and the number of unfavorable cases by u , then the definitions yield $p = f/n$, $q = u/n$. It should be noticed that $f + u = n$ and, since f and u are less than n , p and q , are fractions less than 1. A simple and useful algebraic consequence of these definitions is that $p + q = 1$.

As a further illustration of the definition of *a priori* probability, consider the probability of drawing an ace of spades from a deck of 52 playing cards. Since we know that all 52 cards are different, and there is only one ace of spades; and, since one card is just as likely to be drawn as another, we can apply the definition of *a priori* probability. Thus there is one favorable case and there are 52 possible cases; hence the probability for drawing the ace of spades is $1/52$. If we desire the probability that any ace be drawn, we note that there are now 4 favorable cases, and hence the probability is $4/52$. If we desire the probability that any spade be drawn, we note that there are now 13 favorable cases, and hence the probability for a spade to be drawn is $13/52$ or $1/4$. The probability that we will fail to draw a spade on a single draw may be determined from $q = u/n$. Since there are 39 unfavorable cases, the probability that we will fail to draw a spade is $39/52$ or $3/4$. This last result could have been obtained from the relation $p + q = 1$, for we had determined p to be $1/4$ and thus $1/4 + q = 1$ yields $q = 3/4$.

If we wish to know the probability that a house will burn or that a person will die, we find that the definition of *a priori* probability does not apply. We know that the chances that any house will burn are not the same as those for a different type of house, and the chance that one person will die are not the same as those that another person will die. Thus we must seek another method of evaluating the probability in such situations.

Vital-statistics records enable us to determine

the probability that a person will die. Thus if, out of 100,000 white males of age 16 in the U.S. 158 died within the past year, then the probability that a white male, aged 16, will die during the year is $158/100,000$. The probability that he will live is of course $(100,000 - 158)/100,000$ or $99,842/100,000$. This probability is based on experience as reported in statistics and hence is often called *statistical probability*. Since the probability is determined after the event has occurred many times, it is often called a *posteriori probability*. The probability of life and death, of fire, or of a child aged 8 weighing 70 pounds, or that an ear of corn be 8 in. long, etc., can all be found by reference to appropriate statistics.

The boys who toss a coin to determine which one is to have first turn at a game may have known that their chances were equal from previous experience with tossing coins, that is, by *empirical* probability, or by a little thought about the characteristics of a coin, that is, by *a priori* probability. Regardless of which way the probability is obtained, we expect the result to be $1/2$. In fact, if we toss the same coin many times, we expect the number of heads and tails to be approximately equal.

If it happens in a game of chance that after 600 rolls of the same die the results are that the 3 turned up 300 times, the 4, 200 times and the 1, 2, 5, 6 together only 100 times, then the statistical probability for a 3 is $300/600$ or $1/2$ and for a 4, $200/600$ or $1/3$. Since these results are contrary to the *a priori* probability of $1/6$, we conclude that the assumption on which we based the *a priori* probability, namely, that all sides of the die are equally likely to turn up, is false. In this case we might say that the die is "loaded." Thus, when the two types of probability are not in agreement we seek some explanation as to the reason.

Although *a priori* probability is often convenient to apply in games of chance, it is statistical probability which is of the greatest practical importance. From a knowledge of the probability of death, fire, theft, etc., and the rate of interest earned by invested money, the rates and benefits of life, fire, theft, insurance, etc., are determined.

Probate Court (*prō'bāt*), a court that has jurisdiction of the proof of wills and the settlements of estates. The judge of a probate court is the officer who has charge of the instrument that purports to be the last will and testament of a person deceased. When a party files a will, after the decease of the testator, it is required in most cases that a notice of the same be published, and all interested may then appear at the time of hearing at which it is sought to admit the will to probate. A party offering a will is said to be the *proponent* and the party disputing its authenticity

is known as the *contestant*. If the will, after the witnesses have testified, is not admitted to probate, the judge is said to pronounce the sentence of *intestacy*. In England the custody of the estates of deceased persons formerly vested in the ordinaries, or the bishops of dioceses, except the rights of the crown or of lords in respect to certain manors, but the act of 1857 abolished the ecclesiastical jurisdiction and conferred full and exclusive authority over all testamentary causes to the court of probate.

Probus (*prō'būs*), MARCUS AURELIUS, Emperor of Rome, born in Sirminum, in Pannonia, about 232; died in 282 A.D. The brilliancy of his military achievements caused Emperor Valerian to raise him to the rank of tribune long before the regular age. He commanded in the wars in Africa, Persia, and Germany. Zenobia had conquered Egypt, but he defeated her army and restored it as a Roman possession. Tacitus made him commander in chief of the provinces in the East. In 276, upon the death of the emperor, he was chosen by the army as Emperor of Rome and the senate immediately confirmed the selection. With a large army he invaded Gaul to expel the Germans, who were compelled to retreat across the Rhine. While in Germany he built fortifications at Ratisbon and Neustadt and finally concluded an alliance with the Goths. His administration was eminently successful. While draining the marshes of Sirmium a mutiny broke out among the soldiers and he was assassinated. Carus succeeded him as emperor.

Process (*prōs'ēs*), in law, the whole proceedings in any action, civil or criminal, real or personal, from the beginning to the end. In a more technical sense, the term is applied to different stages of the procedure, such as the terms of the *original process*, which includes the precepts or writs by which one is called into court; the *final process*, or the forms of procedure by which judgment is carried into execution; and the *mesne process*, which covers the proceedings between the other two, embracing all proceedings properly so called, all writs for compelling the attendance of jurors or witnesses, and for other collateral purposes. Mesne and final process are sometimes collectively described by the term *judicial process*, because proceedings in these stages of an action are authorized immediately by the courts, under the hands and seals of their presiding judges. However, in the strict technical sense, process is the means employed for bringing the defendant into court to answer to the action.

The first step in the procedure is to give the defendant *notice* of the issue and pendency of the *original writ*. This notice is given ordinarily by *summons*, informing the party to appear at the return of the writ, and is served upon him by the sheriff, constable, or some other similar

officer. The party who brings such an action is known as the *plaintiff*, being the complainant, and the party against whom the action is brought is termed the *defendant*. The suit is commenced after both parties have entered an *appearance* or an appearance is entered for them, when they are said to be *in court*. Each party now makes a statement of the position taken upon the issues of the suit, such as statement comprising the *pleadings*, after which the issue is joined. Questions of law involved in the cause are determined by the judge, while matters of fact are in most cases decided by the jury. A *verdict* is the decision or conclusion of the jury, while a *judgment* is the decision or sentence pronounced by the court. See also *Courts*; *Crime*; *Habeas Corpus*; *Jury*; *Writ*.

Processing Taxes (*prō's'ēs-īng tāk'sēz*), taxes levied under the Agricultural Adjustment Administration Act on the processors using basic commodities, such as corn, cotton, hogs, and wheat. This act, known as the AAA, was designed to protect the income of farmers, but was declared unconstitutional by the Supreme Court.

Procession of the Holy Spirit (*prō-sēsh'ūn*), in theology, the concept that the Holy Spirit "proceedeth from the Father." This is the belief of the Holy Orthodox Church, while the Roman Catholic Church declares the Holy Spirit to proceed from the Father and the Son equally.

Proconsul (*prō-kōn'sūl*), the governor of a Roman province, having the authority of a magistrate with powers approximately equal to those of a consul of metropolitan Rome. He was frequently chosen from among retiring consuls, or from among the praetors. The pro-consul held office for one year and was in sole charge of the military, judicial, and administrative branches of a provincial government. He could not be prosecuted for poor administration until his term of office had expired.

Procter (*prōk'tēr*), ADELAIDE ANNE, poet, born in London, England, Oct. 30, 1825; died there Feb. 3, 1864. She was a daughter of Bryan W. Procter, and at an early age devoted much time to poetic writings. Her productions include many works which are still read; they include "Legends and Lyrics" and many poems contributed to *All the Year Round*.

Procter, BRYAN WALLER, poet and prose writer, generally known as *Barry Cornwall*, born in London, England, Nov. 21, 1787; died Oct. 4, 1874. He studied at a boarding school and later became a classmate with Lord Byron and Sir Robert Peel at Harrow. In 1807 he entered upon a course of legal studies in London and contributed to the *Literary Gazette*. The death of his father, in 1816, brought him a small estate, and until 1820 he devoted his time largely to soliciting, but in the latter year he began writing under the

pseudonym of Barry Cornwall. His writings include "English Songs," "A Sicilian Story," "Flood of Thessaly," "Dramatic Scenes," and "Memoir of Charles Lamb."

Proctor (*prôk'tēr*), ALEXANDER PHIMISTER, sculptor and painter, born at Bozanquit, Ont., Canada, Sept. 27, 1862; died in Palo Alto, Calif., Sept. 4, 1950. He grew up in Colorado, where he was fond of sketching wild animals, a subject which later won him fame. He studied in New York City and Paris, France, holding his first exhibition of note at the Chicago Exposition (1893). His works of sculpture include "Theodore Roosevelt" (as a Rough Rider, 1921), in Portland, Ore., and a "Pioneer Mother" (1928) in Kansas City, Mo.

Proctor, HENRY A., soldier, born in Wales in 1787; died in Liverpool, England, in 1859. He came to America at the beginning of the War of 1812 as a colonel. Sir Isaac Brock sent him with a force to Amherstburg to prevent Gen. William Hull from landing. On Aug. 5, 1812, he defeated the Americans at Brownstown, thereby contributing much to the fall of Detroit. In 1813 he defeated the Americans near Frenchtown, on the Raisin River, for which service he was promoted to brigadier general. Gen. Harrison expelled him from Ft. Meigs and defeated him in the Battle of the Thames on Oct. 5, 1813. The authorities tried him by court-martial and he was suspended from service, but was later reinstated.

Proctor, RICHARD ANTHONY, astronomer, born in Chelsea, England, Mar. 23, 1837; died in New York City, Sept. 12, 1888. He was graduated from Cambridge in 1860, became a fellow of the Royal Astronomical Society in 1866, and received a fellowship in the London King's Coll. in 1873. In 1873 he made a lecturing tour of America. After observing the transits of Venus in 1874 and 1882, he published many valuable illustrated articles on stars. His death resulted from yellow fever contracted while in Florida. Proctor was a popular lecturer and an efficient writer on astronomical subjects.

Procyon (*prô'sy-ôn*), first magnitude yellow star in the constellation Canis Minor, the lesser dog, visible in the winter sky.

Prodigy (*prôd'i-jī*), a person, especially a child, gifted with a remarkably superior ability in a certain field, such as in music, art, mathematics, or memory. See also *Genius*.

Profit (*prôf'it*), under traditional capitalism, the portion of the joint product of labor and capital which belongs to the employer. The employer may be and often is a capitalist, but he is not always necessarily the owner of the capital employed in commercial or industrial enterprises. Both capital and labor are within themselves helpless, since it is necessary to have an employer or businessman to effect a union and

put both in successful operation. If a large capital and many laborers are employed, it requires much ability to organize and manage a business. The profits of the employer usually depend upon the ability to manage, and, since they are generally proportioned to the volume transacted, large profits imply an increase and not a diminution of wages. Risk and uncertainty are attached to all business enterprises and the greater the elements of uncertainty the larger should be the profits. In general the profits are small upon single commodities, but they are usually quite large in cases where protection from close competition is provided through patents and copyrights, or where the output of an important produce is controlled by large interests so as to create a monopoly.

Profits are classed as gross and net. *Gross profit* is that resulting from the difference between the original cost and the selling price, while *net profit* is what is left after deducting all charges. The proportion which the total profit bears to the capital employed is reckoned on a percentage basis and is called the *rate of profit*. The gain or loss in business is termed *profit and loss*. These items are made a matter of record in bookkeeping, the former being placed on the credit and the latter on the debit side of the ledger.

Progesterone (*prô-jēs'tēr-ôn*), a female hormone. See *Hormone*.

Progestin (*prô-jēs'tin*). See *Puberty*.

Program Music (*prô-grām mû'zīk*), a type of music which, by instrumental means alone, expresses ideas and reproduces the moods and events indicated in the title or the composer's preface. Although known from earliest times, program music in its current meaning is best represented by compositions of the 18th century and later, e.g., Beethoven's "Pastoral Symphony." The development reached its climax in the compositions of Richard Strauss, e.g., "Till Eulenspiegel," and in those of the French Impressionists such as Debussy and his followers. See also *Music*.

Progression (*prô-grēs'h'ūn*), in mathematics, a sequence of numbers each derived from the preceding, according to a fixed law. The numbers which form the progression are called *terms*. An *arithmetic progression* is a progression in which each term is found from the preceding term by the addition of a fixed number, called the *common difference* (which may be positive or negative). Thus 3, 5, 7, 9, 11, 13, . . . is an arithmetic progression in which the common difference is 2, and 18, 16, 14, 12, 10, . . . is an arithmetic progression in which the common difference is -2. A *geometric progression* is a progression in which each term is formed by multiplying the previous term by a fixed number, called the *common ratio* (which may be larger or smaller than 1 and



DURING THE PROHIBITION ERA, 1919-33

Courtesy Brown Bros., N. Y.

A bootlegger selling liquor on a ship outside the three-mile limit

positive or negative). Thus 2, 4, 8, 16, 32, . . . is a geometric progression in which the common ratio is 2; $1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \dots$ is a geometric progression with the common ratio of $\frac{1}{2}$; and 2, -4, 8, -16, 32, . . . is a geometric progression with the common ratio of -2.

In most elementary applications of progressions the number of terms is finite. Geometric progressions in which the ratio is numerically less than 1 and which do not terminate are of considerable importance in more advanced mathematics and are an important basic idea in infinite series.

Prohibition (*prō-ī-bish'ūn*), in politics and social welfare, the outlawing of traffic in liquor, designed to eliminate public consumption of intoxicants. Temperance societies were first organized to limit the use of liquor to reasonable quantities, rather than to teach total abstinence from all forms of intoxicants. Members were pledged to observe moderation, calmness, and self-control, not only for their own good, but for the sake of their fellows. The history of the temperance movement dates from ancient times, and we learn that the Jewish Nazarites acted on total abstinence principles. Mohammedans and some Hindus nominally abstain from intoxicating liquor.

The first temperance society on record is that of St. Christopher, founded in Germany in 1517, whose members were pledged to exercise moderation. An organization formed at East Hampton, Long Island, in 1651, for the purpose of limiting the sale of intoxicants, was the first to be instituted in America. In 1789 a society of farmers was formed at Litchfield, Conn., the members pledging themselves to abstain from the use of

liquor during their farm work. Total abstinence was recommended by H. Humphrey in 1812 and by Lyman Beecher soon after, thus giving rise to various temperance societies. However, the American Temperance Union was not instituted on the basis of total abstinence until 1836. It was followed by a number of similar associations.

A temperance crusade was started at Washington Court House, O., in 1873. It was an organized effort against saloons and resulted in closing many places where liquors were kept for sale. In these campaigns men and women armed with weapons and hymn books either persuaded the keepers to close their places of business or forcibly destroyed their wares. One of the most powerful American societies of temperance workers ever organized is the National Woman's Christian Temperance Union. It has auxiliaries in every state and territory of the U.S. This organization is a union of Christian women for the purpose of educating the young, reforming the "drinking classes," stimulating public sentiment, and ultimately securing legal abolition of the liquor traffic.

The crusade against intemperance was materially stimulated in the British Isles by Theobald Mathew, the apostle of temperance in Ireland. He began work in 1838 and in less than a year secured 1,800,000 recruits to the cause. The Independent Order of Good Templars was founded in England by Joseph Malins in 1868, though similar organizations had operated some years previously. Henry Edward, Cardinal Manning (*q.v.*) in 1873 began a vigorous temperance movement among the Roman Catholics.

Prohibition of the sale and manufacture of liquor is the climax of the temperance movement. Legal enactments were directed against

the use of liquor as early as 1639 in the Massachusetts colony, and Connecticut and several other colonies enacted similar laws. The first restrictive liquor law was passed in Maine in 1846, and in 1851 a more stringent prohibitory one, known as the *Maine Law* and drafted by Neal Dow, was enacted in its place. Prohibition laws were enacted in New York, Vermont, Connecticut, New Hampshire, Kansas, Iowa, Rhode Island, and many other states. From 1907 to 1918, anti-liquor laws were enacted in a majority of the states, in some states "local option" laws and in others prohibitory or "bone dry" laws. The Prohibition party (*q.v.*) had a marked influence upon public policy. In 1916, the Webb-Kenyon law prohibited the transportation of liquor from a "wet" to a "dry" state. Congress, in 1917, added a prohibitory law to the Postoffice Appropriation Bill, forbidding the sending of liquor advertising by mail. Congress also passed the 18th (Prohibition) Amendment in 1917. Adopted by the states in 1919, it was supplemented by the Volstead Act, which defined intoxicating beverages as those containing at least 1½ per cent of alcohol. The Volstead Act was difficult, however, to enforce and was openly defied by millions. As it became evident that prohibition was a failure, the clamor for repeal grew, and finally in 1933 the 21st Amendment, repealing the 18th, was adopted. See also U.S.: PROHIBITION; Volstead Act.

Prohibition Party (*prō-i-bish'ūn pār'tī*), a political organization of the U.S., first established as a national organization in Chicago on Sept. 1, 1869. The prohibition movement in the U.S. dates from 1812, and the first law providing for the prohibition of the liquor traffic was enacted in Maine in 1846. Vermont and Rhode Island passed a similar law in 1852, Connecticut followed in 1854, and the states of New Hampshire, New York, Michigan, and Iowa enacted such laws in 1855. These laws were more or less modified or repealed, but the movement continued to gain many adherents. James Black of Pennsylvania, the party's first candidate, was nominated for President in 1872.

The party was divided on the money question in 1896, the two opposing factions being known as the Prohibition party and the National party. The former made prohibition the single issue and its candidate for President, Joshua Levering, received 130,560 votes, while the latter supported prohibition, bimetalism, and other issues under the leadership of Charles E. Bentley, who received 14,392 votes. After prohibition was constitutionally adopted, in 1919, the Prohibition party gradually declined. In 1928 it received only 20,101 votes, but continued an active political existence, placing candidates on the ballot in every Presidential election, and functioning with increasing vigor

after the repeal of prohibition in 1933. During World War II, the prohibition issue again became prominent, and was largely guided by the party.

Projectile (*prō-jēk'tīl*), missile discharged from a firearm, usually a missile of the elongated type.

Projection (*prō-jēk'shūn*), a geometrical transformation by which a point, line or surface is converted into another line or surface. The branch of geometry treating this process is known as projective geometry. The simplest projection consists of dropping a perpendicular from a point to a line or plane. The foot of the perpendicular is called the projection of the point. Lines may be projected upon a plane by projecting two points on the line onto the plane.

Projection Apparatus (*prō-jēk'shūn āp-ā-rā'tūs*), an optical device for producing an enlarged image upon a screen. In the still projector, photographs or drawings on glass slides are used, while the moving-picture projector uses photographs on a strip of film. All projectors require a powerful light source behind the film. The light from the lamp is usually concentrated upon the film by condenser lenses. The image formed upon the screen is produced by the objective lens which is placed between the film and the screen. Because the objective lens inverts the image, the slide or film is inserted upside down.

In the motion-picture projector a shutter is used to cut off the light during the process. If 16 or 24 separate scenes are thrown upon the screen every second, the eye is incapable of observing the individual scenes and an impression of continuity is obtained.

In the opaque reflector type of projector, any type of picture can be used.

Prokofieff (*prō-kōf'i-ēf*), SERGEI SERGEEVICH, composer, born in Sontsovka, Russia, April 23, 1891; died near Moscow, March 4, 1953. At the age of nine, he composed an opera, "The Giant," and began (1902) his music studies with Glière. On the advice of Glazunoff, he entered the St. Petersburg conservatory in 1904, from which he was graduated in 1914. In 1918 he left Russia, went first to Japan, then to the U.S., where he gave many concerts; he also toured Europe, winning much acclaim as a pianist and leading composer. From 1920 to 1927 he lived mostly in France, also in Bavaria, conducted (1921), in Chicago, the *première* of his comic opera "The Love for Three Oranges," revisited Russia in 1927, and finally settled down there in 1934.

He composed eight operas (*e.g.*, "War and Peace," 1941-42), six ballets (*e.g.*, "The Age of Steel," 1927 and "The Prodigal Son," 1929), cantatas (*e.g.*, "Alexander Nevsky," 1939), seven symphonies (the first, the popular "Classical Symphony," 1918, the last, "Symphony No. 7," February 1953), orchestral suites (*e.g.*, "Lieutenant

Kijé," 1937), and three ballet suites (e.g., "Romeo and Juliet," 1936). He also wrote the symphonic fairy tale "Peter and the Wolf," first performed in 1936, many concertos for the piano, violin, and cello, chamber music, and songs.

His style, though repeatedly changing: from a simple to a highly complex one, is distinctly individual, colorful, witty, and often heroic.

Prolactin (*prô-lăk'tîn*) or LACTOGENIC HORMONE, a hormone (a substance secreted internally), produced by the anterior portion of the pituitary gland, which is necessary for normal lactation (production and flow of milk in the female breast) after childbirth. Prolactin has been isolated in pure crystalline form from pituitary tissue.

Prolan (*prô'lăn*), an ovary-stimulating hormone, produced by the anterior lobe of the pituitary gland, which governs the production of estrogen and progesterone by the ovaries to regulate the female functions of ovulation, menstruation, and maintenance of pregnancy. Similar substances to prolan, with similar effects, are obtainable from placental (afterbirth) tissue and from pregnant mares' serum, and are used in treatment of certain female hormone deficiency states. See also *Stilbestrol*.

Prometheus (*prô-mě'thê-ûs*), in Greek legend, the great benefactor of humanity, son of the Titan Iapetus and the ocean nymph Clymene, and brother of Atlas and Epimetheus. Prometheus, whose name means forethought, was believed to have taught mankind the arts of living and to have saved men from Zeus' anger. Zeus deprived mankind of fire, because Prometheus tricked the god into taking the inferior portion of a sacrifice, when the portions were allotted between the gods and men. Prometheus, however, stole some fire from heaven and restored it to men. Zeus then had the first mortal woman, Pandora, made; he sent her with a box containing many evils and afflictions for men, not to Prometheus, who foresaw the difficulties she would cause, but to Epimetheus, who welcomed her. For defying Zeus on several occasions, Prometheus was chained to a mountain, where each day an eagle fed upon his liver—which was restored during the night. Hercules freed Prometheus from this torture much later.

Prometheus was represented as wiser than Zeus, although less powerful; his name has often been used to signify a rebel. The Greeks probably adopted him from an earlier fire god, and the stories about him were many.

Promethium (*prô-mě'thê-ûm*), formerly known as ILLINIUM, a solid chemical element of the rare earth group. Its atomic number is 61; its weight is 147 (not officially determined); and its symbol is Pm. This element, which they named illinium, was reported as being found in

nature by Prof. B. H. Hopkins and his co-workers at the Univ. of Illinois. However, its existence in nature is still unconfirmed. The first actual chemical identification of the element, for which the name promethium has been adopted, was made in 1945, when radioactive isotopes were prepared from the fission products of uranium.

Promissory Note (*prôm'is-sô-rî nô't*), a promise in writing to pay a certain sum of money, either on demand or at a fixed future time. When the promise is to pay it to the payee or his order, the note is negotiable. It is signed by the maker, who is termed the *payer*. A note may be sold or transferred either with or without recourse on the payee. In the former case he merely signs his name on the back, when it is said to be *endorsed*, but to hold him liable in some states it is necessary to protest the note. Those who sell or transfer a note without assuming any responsibility write their name under the phrase, *Without recourse*. Below is the usual form of a negotiable promissory note: \$680.00 Philadelphia, Pa., Sept. 30, 19—.

Three months after date, for value received, I promise to pay John Doe, or order, six hundred eighty and 00/100 dollars, with interest at the rate of six per cent per annum.

Richard Roe.

Pronghorn (*prông'hörn*) or PRONGBUCK, a small goatlike antelope, *Antilocapra americana*, formerly seen in enormous herds, on the Great Plains west of the Mississippi, along with bison. Although commonly called an antelope in the U.S., the pronghorn differs markedly from the true antelopes of Africa; it resembles, in some characteristics, goats, deer, and giraffes. One of its characteristic peculiarities lies in its unique horns. These are present in both sexes, though larger and with a short prong in the males. As in goats, the horns have a bony core that is never shed. This core is in part covered with hairy skin, as in giraffes, and in part with horn, as in antelopes. But unlike antelopes, the pronghorn sheds the hairy and horny covering annually.

The adults are about 3 ft. high at the shoulders, swift, and shy but full of curiosity. Their flesh is of fine flavor, and they are much sought as game.

Pronoun (*prô'noun*), in grammar, a word used instead of a noun, as *I, we, you, his, themselves*. The properties are *gender, person, number, and case*, all of which are the same as that of its antecedent, except its case, which depends upon the construction of the clause in which it is found. Pronouns are either *personal, possessive, relative, or interrogative*. *I, he, and you* are personal; *his, her, and their* are possessive; *what, which, and who* are relative; and *what, which and who*, are interrogative pronouns. To these are sometimes added *indefinite*

pronouns, as *any*, *much*, and *some*. Such words as *that*, *this*, and *these* are termed *demonstrative pronouns*.

Proofreading (*prōōf'rēd-ing*), the practice of checking typesetting and make-up for printed matter. The typesetting or, as it is generally called, composition, may be set by hand or on a typesetting machine. A proof of the type set is usually made on a hand-operated proof press, and it is then read by the proofreader as a check against the original copy for the purpose of catching errors that occur in setting up the type. A copyholder usually reads from the original copy and the proofreader marks any errors on the proof. The corrections are then made in the set-up text in accordance with the proofreader's marks, and another proof is taken for the proofreader to see that the errors previously marked have been properly corrected. This is called revising the proof. The proofreader also checks the make-up after the matter is made up into pages for proper spacing and placing of illustrations. Intense concentration is necessary on the part of the proofreader to prevent his missing any errors which may cause the spoiling of a costly piece of printed matter. It is the proofreader's responsibility to catch all errors before the printing is done.

STANDARD PROOF MARKS

X	Defective letter	⊙	Colon	no ¶	No paragraph
↓	Push down space	;	Semicolon	wf	Wrong font letter
↑	Turn over	'	Apostrophe	st	Let it stand
⊖	Take out	⌈ ⌋	Quotation	tr	Transpose
⊕	Insert at this point	-	Hyphen	cap	Capitals
∧	Space evenly		Straighten lines	sc	Small capitals
✱	Insert space	→	Move over	lc	Lower-case letter
⊘	Less space	□	Em quad space	it	Italic
⊙	Close up entirely	—	One-em dash	Rm	Roman letter
⊖	Period	—	Two-em dash	?	Verify
∕	Comma	¶	Make paragraph	○	Spell out

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Propeller (*prō-pēl'ēr*), a rotating mechanism in the form of an attachment used in conjunction with other mechanism to push or propel water craft or aircraft by converting engine power into motion. The propeller receives its power

through a propeller shaft which is driven by an engine—steam, gasoline, or diesel. In smaller sizes propellers are usually cast solid, though they may be built up for use on large ships by bolting hub and blades together so that a damaged blade can be replaced without a new propeller's having to be installed. Propellers may have two, three, four, or more blades; they come in several types, sizes, and styles depending upon the desired applications; they can be of steel, cast iron, or manganese bronze. The types of propellers used on motorboats or yachts are generally true pitch with elliptical blades, but special shapes are sometimes required, with variable pitch. They are made to rotate either clockwise or counter-clockwise; the type called a "reversing propeller," used on sailing yachts with auxiliary engines, has blades which are adjusted or reversed by a linkage mechanism inside the boat. There is also a "feathering" propeller for these boats in which the blade surfaces flatten parallel to the shaft to cut down drag or resistance under sail.

The aircraft propeller is a rotating blade, with the upper or camber surface curved and the lower or thrust surface more nearly flat, similar to the top and bottom of a wing. Two basic types are the *fixed-pitch propeller* and the *constant-speed controllable-pitch propeller*. The latter is operated electrically, hydraulically, or mechanically; its principal parts are the hub, power- and speed-reduction units, and blades. Further refinements of the controllable-pitch propeller include dual rotation, or the use of two multiple-blade propellers as a single-shaft unit to reduce the required size of blades; reverse thrust or pitch, in which blades may be turned to a complete negative angle as an aid to maneuverability and landing; and automatic synchronization, or the control of multiple engines as one. Blades for modern aircraft propellers are made of aluminum or steel alloys, the latter usually being processed into hollow form. Aircraft propellers rotate at speeds of from 900 to 2,500 revolutions per minute, the tips of the blades cutting the air at as much as 1,335 m.p.h. Thus the propeller slices continuously through a large amount of air, producing con-

l.c. / 5 ¶ Congress shall ^{make} ~~pass~~ ^{1.} ~~no law~~ ^{respecting} ~~pertaining~~ to an establish- ^{rom caps} ~~ment of Religion;~~ ^{l.c.} or Pro^{scribing} ~~phibiting~~ the free exercise ³¹ there^{of}; or a ^{form of} bridging the free ^{to} right ^{peaceably} to speech, or of the press; ^{or} the right of the people ^{to} assemble ^{cap. 2} peaceably, and to ask the ^{govt} government ~~of~~ for a redress ^{cap. 2} of grievances.

siderable "lift" or thrust for the craft that rides behind it.

Prophecy (*prôf'ê-sî*), a prediction of future events, either by divine inspiration or as the result of any kind of ecstatic state of mind. The writings of almost all religious faiths contains prophecies. In Western civilization the best known are the prophecies of the Jewish prophets (*q.v.*); Christianity saw in their predictions a heralding of the coming of Christ, as the Messiah (*q.v.*). In ancient Greece, the oracles pronounced prophecies which often formed the motifs for plots in Greek tragedies (*e.g.*, the Delphian oracle to Oedipus). In Roman mythology the sibyls (*q.v.*) possessed the power of prophecy, and some of their utterances are extant (Sibylline Books). Oracles are also encountered in Oriental religions. See also *Oracle*.

Prophets (*prôf'êts*), in the Old Testament, the sequence of men who felt themselves to be representatives of the Divine Being and to speak in His name. The prophets have to be understood much less as forecasters than as poets, philosophers, moralists, lawmakers, and sometimes even musicians. Samuel should be regarded as the first actual prophet.

The sequence of great prophets began in the 8th century B.C. Elijah and Elisha were among the early prophets who left no written works, but the prophets after 800 committed their messages to writing.

Sixteen prophets left books that became recognized as a part of the Old Testament canon. They are the *four greater prophets*, Isaiah, Jeremiah, Ezekiel, and Daniel, and the *12 lesser prophets*, Hosea, Joel, Amos, Obadiah, Jonah, Micah, Nahum, Habakkuk, Zephaniah, Haggai, Zechariah, and Malachi. Some of the prophets belonged to the kingdom of Judah, some to the kingdom of Israel; Ezekiel and Daniel, to the period of the Babylonian captivity, and Haggai, Zechariah, and Malachi, to the period after the return from captivity.

Being a prophet meant belonging to a certain order or profession, and this profession developed only gradually, as is shown in the Books of Samuel and the Books of Kings. The first prophets were competitors of the ecstatic der-vishes, "the prophets of Baal." After Samuel, schools for prophets, comparable to later Greek schools of philosophy, were founded.

The prophets guided the people, exhorted them, took part in local politics, and were later also interested in national literature. During the Exile, the prophets created the nucleus around which all forces for keeping the Jewish religion alive crystallized. In spite of their general and naturally pessimistic outlook, they never tired of emphasizing the eternal hope of the Jews for the coming of the Messianic era.

Judging from the preserved utterances of the prophets, they must have been men of a tremendously intense religious experience; their concern with social and ethical problems assisted greatly in the growth of Jewish moral teachings.

According to the prophets, sin is identical with the inability to recognize the nature of God and it follows from violation of the covenant of God with His people. Human history is dictated by God as He rules nature, but man has the responsibility for his own individual decisions. See *Bible*.

Proportion (*prô-pôr'shûn*), in mathematics, when two ratios are equal, the four quantities involved are said to be in proportion. Thus, if $a/b = c/d$, then a, b, c, d are proportional. The fractional notation for a ratio, a/b , is gradually replacing the older notation $a : b$, and the equal sign is quite generally replacing the older sign of four dots, $:$, to indicate a proportion. In the older symbols the proportion $a/b = c/d$ would be written $a : b :: c : d$. In the ratios a/b and c/d , a and c are called the *antecedents* and b and d are called the *consequents*. In the proportion $a/b = c/d$, a, b, c, d are sometimes referred to as the *first, second, third, and fourth proportionals*; a and d are called the *extremes*, and b and c are called the *means*. Operations with proportions can be easily deduced from the algebra of simple fractional equations.

Proportional Representation (*prô-pôr'shûn-al rêp-rê-zên-tâ'shûn*) (frequently used in its abbreviated form, P.R.), a method of electing a body of representatives, designed to assure representation to like-minded groups of voters in proportion to their voting strength. If, for example, a city council of nine members is to be elected by proportional representation and five-ninths of the voters support ticket A, three-ninths, ticket B, and one-ninth, ticket C, the council chosen will contain 5 members of ticket A, 3 of ticket B, and 1 of ticket C. A majority can elect a majority of the members but not all, and any substantial minority is sure of representation.

There are different kinds of proportional representation. The one used almost exclusively in English-speaking countries is called the Hare system (after one of its originators, Thomas Hare of England) or the single transferable vote. This system is in use in a number of American cities, notably Cincinnati, Toledo, Worcester, Cambridge, Lowell, Wheeling, and Yonkers, and was used for five elections each in New York City, and Cleveland. It is used for all elections in Eire (Ireland), for parts of the provincial elections in Manitoba and Alberta, for city elections in Winnipeg and Calgary and for some important elections in Australia, New Zealand, South Africa, and The Netherlands.

The Hare system allows each voter to express

an order of choice among the candidates, usually by numbers 1, 2, 3, etc. Several members are elected together from the same district or at large, but each voter helps to elect just one—the first of his choices that can be elected with his help. The quota of voters prescribed as sufficient for election is not a majority but a smaller fraction of the total, its size usually depending on the number to be elected. The surplus votes of candidates with more than the quota, and all the votes of candidates with too little support to win, are transferred to the next choices of the particular voters who cast them. With the aid of these transfers most of the ballots are made effective in electing representatives.

The system requires no party or other division into groups for its operation, but when there are distinct groups the representation of each depends on the number of quotas its voters are able to fill and is therefore proportional to its voting strength. The plan has frequently been advocated as a means of preventing monopolies of representation by dominant political machines and assuring a voice to independent and other minorities. It also prevents control by any minority at the expense of a divided majority.

Most of the countries of Continental Europe outside the Russian sphere of influence, including France, Italy, Switzerland, Belgium, The Netherlands, Denmark, Norway, Sweden, and the American and French zones of Germany, use party list systems of proportional representation for their national and local elections. List systems are also used in several parts of Latin America. Differing in details, they all permit the voter to cast a vote for a list of candidates and give each list approximately the same share of the seats that it has of the votes. They give the voter less freedom than the Hare system in that he is not permitted to direct the transfer of his vote from a candidate of one party to a candidate of another if his first choice cannot be helped by it. See also *Vote*.

Propylaea (*prōp-yl-ē-ā*), in Greek architecture, the entrance building to a group of edifices around an open square; more specifically, the entrance to the Acropolis of Athens, built in the 5th century B.C.

Prose (*prōz*), the ordinary language used in speaking or writing, distinguished from poetry, which is cast in poetical measure or rhythm.

Proserpina (*prō-sēr-pī-nā*), Roman name for the Greek goddess *Persephone*, daughter of Zeus and Demeter. According to legend, she was carried by Pluto to the nether world. After Demeter learned of this, she pleaded with Pluto; he finally agreed that Proserpina should spend half of every year with her mother and the heavenly gods and the other half with Pluto beneath the earth. This

legend has been taken to represent the planting of seeds in the earth.

Prosody (*prōs'ō-dī*), the science of versification. Prosody is concerned with the principles governing such matters as the distribution and arrangement of syllables into poetic feet (*i.e.*, iambic, trochaic, anapaestic) according to their accent or quantity; with the structure of the metrical line; with the distribution of pauses (caesural and terminal); with rhyme, rhyme-schemes, and stanza patterns; and with all other technical aspects of verse composition.

Prostate Gland (*prōs'tāt glānd*), in medicine, an organ found only in the male. Consisting of fibrous tissue, some muscle, and some mucus-secreting gland tissue, it is located at the bottom of the bladder where it surrounds the beginning of the tube that carries the urine to the exterior. It measures about $1\frac{1}{2}$ by 1 in. and weighs from $1\frac{1}{2}$ to 2 ounces. The glandular tissue within the prostate empties its mucus into two ducts that open into the urethra (the tube that carries the urine from the bladder). At the place where these ducts open, the tube carrying the sperm also enters the urethra, and the secretion of the prostate dilutes the sperm, providing a proper medium to keep them alive while they fertilize the ovum. Under the influence of the sex hormones, the prostate is inactive until puberty and ends its activity with senility. It is frequently a site of infection, and elderly men often suffer from non-malignant tumors of the prostate which compress the urethra. However, the prostate may also be the site of a cancer.

Prosthetic Appliances (*prōs-thē'tik ā-plī-gns-ēz*). See *Artificial Limbs*.

Prosthodontia (*prōs-thō-dōn'thī-ā*). See *Dentistry*.

Prothrombin (*prō-thrōm'bīn*), a material present in the blood which forms thrombin and which is obtained from blood plasma. Thrombin is a coagulating enzyme found in the blood which changes fibrinogen to fibrin, and thus causes blood to coagulate. Other names for thrombin are thrombace and zymoplastin.

Prostitution (*prōs-tit'ū-shūn*), the practice of promiscuous sexual intercourse for pay. Prostitutes as a class formed a part of ancient religious ritual in Babylonia, Assyria, and other Oriental countries. In Greece, the *hetærae*, a group of women, many of whom were born as slaves, but who were frequently learned and accomplished, enjoyed a social status hardly surpassed by later women until the modern days of feminine equality. The Romans instituted police registration of prostitutes, but in the days of Rome's decline elevated them to positions of wealth and influence. Christian moralists deplored the vice, and, while making vain efforts to suppress it, took a more charitable view of the unfortunate

devotees of the trade than did the pagans. The armies of the Crusades spread the practice over larger areas. Severe efforts to suppress prostitution were made during the Reformation, particularly in Germany, where licensed houses, *i.e.*, brothels under police regulation, were abolished. The Puritan restrictions in England were equally severe. In France, however, the Roman practice of registration was revived in 1778, and in Berlin prostitution was declared a "necessary evil" in 1792. The last attempt to suppress it in Germany took place as late as 1845, and proved a complete failure.

During the 19th century, prostitution and the transportation of women for such purposes became highly commercialized (see *White Slave Traffic Act*). A congress met in London, England, in 1899 for the purpose of regulating such traffic and to meet the problems created by organized international prostitution. The U.S. passed the Mann Act in 1910, instituting severe penalties for the transportation of women for immoral purposes over state lines. Also in 1910, 13 countries signed, at Paris, France, an international convention for the suppression of the white slave traffic. This agreement was effective in changing international law relating to prostitution in certain countries. The League of Nations assumed general supervision over the execution of such agreements, calling an international conference for this purpose in 1921. The U.N. adopted (1946) and implemented (1956) the earlier actions of the League.

In the Western world, governments differ in their treatment of prostitution. The licensed house is more or less characteristic of the European continent, but it has been proscribed in France, parts of Germany, and some other countries such as Switzerland, The Netherlands, and the Scandinavian countries. It also does not exist in the U.S., Great Britain, and other English-speaking countries.

In the U.S., prostitution manifested itself most openly on the frontier, particularly where a blending of cultures took place, as in Louisiana. For over a century New Orleans was associated with "tenderloin" and "red light" districts; New York, long the principal port and mecca for immigrants, has had its fair share of notoriety; Chicago, the gateway to the West, grew up in a lusty era and at one time welcomed the prostitute to its streets. But it was on the mining frontiers of California, Colorado, Nevada, New Mexico, and other western states that prostitutes and dance-hall girls became colorful and robust figures. Once the country was settled, prostitution became purely an urban problem in an era of growing industrialization. Today, prostitution is mostly connected with organized gambling.

Allied with the evils of prostitution, particu-

larly in war time, are those of juvenile delinquency (*q.v.*), the spread of venereal diseases (*q.v.*) and especially the problem of young girls engaging in prostitution.

In modern times, the sociological causes which make women turn to prostitution are thought to include unemployment, bad working conditions, harsh parental treatment, overcrowded and promiscuous living conditions, demoralizing urban conditions, bad examples of luxurious living set by the wealthy, demoralizing literature and amusements, and the efforts of panders and libertines to entice girls and women into immorality.

See also *Crime; Juvenile Delinquency*.

Protagoras (*prô-täg'ô-ràs*), Greek philosopher (ca. 480 B.C.-ca. 410 B.C.). Although none of his written works survive, his ideas are fairly well known since his contemporary, Socrates, refers to him often. He became a Sophist (*q.v.*) after he had studied the earlier Greek philosophers, especially Heraclitus, and he played an important part in the study of philosophy and of grammar and rhetoric during his time. Pericles sent him to rule certain Attic colonies, but he was later exiled from Greece as an atheist. His treatises were publicly burned and he died far from his native land.

Protagoras is famous for his sentence: "Man is the measure of all things." Actually, this formula expresses his belief in the ultimate subjectivism and relativism of all judgments. He insisted that we know only what we perceive by our senses. In doing that, however, we know only our perception and not the thing in itself, the subject proper. Out of this theory, he concluded that there is no objective good and evil, but that good is only what the laws of a country declare to be good. Furthermore, no objective virtue exists, but only virtue relative to given conditions. Knowledge can never be absolute, since it is only the knowledge of the knowable and the knowable consists of the sum total of our perceptions. Thus, it is only natural that Socrates and Plato, with their belief in absolute values, opposed him.

Protargol (*prô-tär'göl*), a compound of silver and albumen which contains about 8 per cent of colloidal silver and of indefinite composition chemically. It is soluble in water and glycerol, and is used, in weak solution, as an antiseptic in specific infections of mucous membranes. The solution is sensitive to light. Preparations of somewhat similar composition are known by the commercial names of argonin, argyrol, nargol, novargan, progranol, collargol, electargol, etc.

Protection (*prô-tēk'shūn*), an economic theory by which governments seek to limit imports for the benefit of domestic (*i.e.*, native)

manufacturers. The principle of protection was recognized distinctly by the first tariff levied in the U.S., in 1789, though the amount of protection was moderate. It has been the policy of the government to combine a protective tariff tax with the plan of internal improvements at national expense, and such a policy has been sustained during all its history, except in the period from the establishment of the Walker tariff in 1846 to that of the Morrill tariff in 1861.

Writers on political economy are divided as to the practical effect of a protective tariff. It is claimed, on the one hand, that it is absolutely necessary to protect home industry to enable the producers of a protected article to receive in return for their services a fair remuneration. Those taking the opposite view assert that the uniform effect of the policy is to render the article produced both expensive and bad. Tariff duties are usually of two classes—protective and prohibitory. A *protective tariff* aims to provide conditions under which articles of foreign and home manufacture can compete in the market on terms nearly equal, while a *prohibitory tariff* has the effect of excluding foreign products from the market.

The protective system was first proposed on a large scale by an Italian in the suite of Catherine de' Medici of France; legislation developed whereby retaliatory tariffs were levied in a number of countries, as the tariff of England in 1692, which taxed the goods imported from France on an average about 75 per cent. In the period between 1818 and 1824 all bounties to manufacturers were abolished in Britain, and this, with the repeal of the corn and navigation laws, ended the protective policy in that country. See *Tariff*; *Free Trade*, etc.

Protector (*prō-tēk'tēr*), the official title of one appointed in England as a regent of the kingdom during the minority or incapacity of the sovereign. The Earl of Pembroke was among the first protectors, serving in 1216 during the minority of Henry III. Oliver Cromwell assumed the title of Lord Protector in 1653 over England, Ireland, and Scotland, serving until 1658, and was succeeded in that capacity by Richard Cromwell.

Protectorate (*prō-tēk'tōr-āt*), a condition of political dependence under which one nation assumes control of the domestic, and, especially, the foreign and military affairs of another. In modern times, the protected nation is always inferior in strength, and the relationship implies an element of force and coercion. A protectorate is an adjunct to the empire of the protecting nation, but is not included among its territories nor incorporated within its metropolitan domain.

Proteids (*prō-tē-īds*), the name of several important animal and vegetable compounds, some

of which are found in solutions or viscous solids in nearly all animal and vegetable organisms. They are formed exclusively in plants and undergo but slight alteration when consumed as food and stored up by animals. However, man derives the proteids, or nitrogenous foodstuffs, principally from grains, vegetables, eggs and milk, and the flesh of animals, birds, and fishes. The constituents of proteids are similar to those of protein, containing carbon, hydrogen, nitrogen, oxygen, and sulfur.

Protein (*prō'tē-in*), the name of certain chemical substances which occur in the organism of plants and animals. They are composed principally of oxygen, carbon, nitrogen, and hydrogen. These substances are important as food, serving to furnish heat and to repair and build up the body. The proteins are classified, not according to their chemical composition, but according to their physical properties and their action upon certain reagents. They include the foods known as proteids and nonproteids, of which the former, or albuminoids, are the most important. The albuminoids, known as *true proteids*, are exemplified in the gluten of wheat, the albumin of eggs, and the casein of milk. See *Agriculture: FOOD AND NUTRITION*.

Proterozoic (*prō'tēr-ō-zō'ik*), or PRE-CAMBRIAN, an era in geological time division, which is divided into two periods, the Archean and Algonkian. The U.S. Geological Survey assigns all time prior to the Paleozoic to this era. The rocks of the Archean period are predominantly igneous, and are composed of large masses of lava flows with some interbedded sediment; the whole is cut by granite intrusions of considerable extent. The Algonkian rocks are chiefly sedimentary and were deposited on layers of eroded Archean rocks. Although it is possible that in Archean times there existed tiny animals which secreted lime, there was probably little if any animal life in this period. In the latest Algonkian rocks, however, the fossils of what were probably brachiopods or crustaceans have been found.

Protesilaus (*prō-tēs-ī-lā'ūs*), King of Phylace, in Thessaly, son of Jason. It is related in the *Iliad* that he was the first who leaped from the ships upon the shore of Troy, and Lucian says that he was killed by Hector, being the first Greek to fall in the Trojan War. The affection between Protesilaus and his wife Laodamia is celebrated by the poets. After his death she prayed to be permitted to converse with him for the space of three hours. This prayer was granted and he was conducted from the lower world by Mercury, but when he returned his wife killed herself and accompanied her husband.

Protestant Episcopal Church. See *Episcopal Church*.

Protestants (*prō'tēs-tants*), the designation applied to Christians who deny the authority of the Pope and hold to the right of private judgment in the matter of religion. The name was first applied to the princes and other adherents of Luther, who, at the second council of Spire, held on Apr. 19, 1529, protested against the decree of the majority, representing the Roman Catholic states of Europe. This decree involved a virtual submission of the reformers, who not only dissented from the decree, but appealed to a general council. Among the leading princes who followed the leadership of Luther were Landgrave Philip of Hesse, the Electors George of Brandenburg and John of Saxony, Prince Wolfgang of Anhalt, and Princes Ernest and Francis of Brunswick-Luneburg. Many imperial cities joined the movement under Luther. They were Ulm, Strasbourg, Nuremberg, Constance, and others. During the Thirty Years' War (1618-48) two major Protestant sects developed. In addition to the Lutherans, who called themselves the "Lutheran Church," there appeared the "Reformed Church," which was led by John Calvin (*q.v.*).

The Protestant churches include the Christian denominations which are not Roman and Greek Catholic, though several branches of the Anglican Church do not accept the classification as historically correct when applied to them. Among the fundamental doctrines of Protestantism are the supremacy of the Bible above bishops and councils, individual responsibility, justification by faith, and freedom within the authority of the Bible of conscience and worship. The branches of the Protestant Church are more or less widely distributed, though the Teutonic peoples of Northern Europe and their descendants have had and still make up the largest membership. There are about 20 major Protestant denominations or communions and about 200 smaller sects and denominational groups within Protestantism. The Protestant churches of the world have a membership of about 135,000,000. See also *Creed*.

Proteus (*prō'tē-ūs*), a Greek sea god known as "The Old Man of the Sea," regarded a son of Neptune. He is represented as a marine deity, who tended flocks of seals at the bottom of the sea, but at the hour of noon came up to the island of Pharos, on the Egyptian coast. It was his custom to slumber beneath the grateful shade of the rocks while surrounded by flocks of seals, and his coming was awaited with interest, since he possessed the gift of prophecy. Those consulting him were obliged to hold him in their embrace, as he endeavored to escape, and for that purpose changed himself into various hideous forms and objects. When at last wearied from efforts to escape, he foretold future events and again dived to the bottom of the sea, accom-

panied by all the marine animals he tended.

Proton (*prō'tōn*), the positively charged fundamental particle which is one of the constituents of all known matter. The charge of the proton is 1.602×10^{-19} coulomb, numerically the same as the charge of the electron although with opposite sign. The mass of the proton is 1.672×10^{-24} gram, about 1,840 times greater than that of the electron. Protons constitute the nuclei of hydrogen atoms; they may be thought of as hydrogen ions. All other atoms contain protons and neutrons in their nuclei; the number of protons in an atom is its *atomic number*, while the total number of protons and neutrons is the *mass number*. See also *Atoms*.

High-energy protons constitute about 90 per cent of the cosmic rays reaching the earth from interstellar space. Recently, a particle known as the *antiproton* has been discovered, which has the same mass as that of the proton but carries a negative rather than a positive electrical charge. When a proton and an antiproton come near one another, they are "annihilated"; that is, their combined mass is completely converted into energy, in the form of two high-energy gamma rays. The reverse process, in which a high-energy gamma ray "materializes" into a proton and an antiproton in the presence of another atomic nucleus, is the one by which the antiproton was first discovered.

Protoplasm (*prō'tō-plāz'm*), the viscous and more or less transparent material, made up of more or less of all the elements of the human body, constituting the essential substance of living cells, upon which depends all the vital functions of nutrition, secretion, growth, irritability, mobility, and reproduction. The protoplasm of most cells, seen under high magnification, appears as a spongy network (spongoplasm) enmeshing a more fluid substance (hyaloplasm). Within the nucleus of the germ cells (ovum in the female and spermatozoon in the human male) there may be seen at the time of cell division after union of the male and female germ cells (*q.v.*), an orderly subdivision and rearrangement of parts of the nuclear protoplasm (called nucleoplasm) into chromosomes (*q.v.*). Within these chromosomes are linearly arranged the elementary bodies or units of inheritance, called genes (*q.v.*), which by interaction with the genic and protoplasmic complex of the cell of the opposite sex with which they are combined, control or condition the development of hereditary characteristics. In short, the gene within the chromosome within the nucleus of the germ cell is the "physical basis of heredity."

Protozoa (*prō-tō-zō'ā*), one of the subdivisions of the animal kingdom. It is a division of the invertebrate animals, embracing those that have a simple organism, reducible to a cell or

PROUDHON

cell contents. Cuvier and Agassiz include the vertebrates, articulates, mollusks, and radiates among the distinct divisions of the animal kingdom, while others add a fifth branch, the protozoa. However, the last mentioned, as formulated by some writers, includes forms of life that are now known to be plants and others are embryonic forms of crustaceans, mollusks, and worms. As generally defined, the protozoa include the foraminifera, rhizopods, and some of the infusoria. All the animals belonging to this division are minute and but few can be seen without the microscope. While a few live in moist earth or as parasites on or in other living organisms, the larger number are found in fresh and salt waters. The food is taken into the protoplasm, the name applied to their nearly structureless substance, either by a specialized mouth, or by any part of the cell substance, in the form of particles. As a rule they are incapable of assimilating nitrogen, since their cells consist largely of nitrates or carbonates. Reproduction is usually by spore formation, fission, or germination. Sponges belong to the protozoa and constitute the largest form. An infusore is said to be the cause of hay fever and other diseases, but many species are important in that they act as scavengers. Extensive beds of rocks have been built up by the skeletons of these animals.

Proudhon (*proo-dón'*), **PIERRE JOSEPH**, political writer and economist, born at Besançon, France, July 15, 1809; died in Passy, Paris, France, Jan. 16, 1865. He was the son of a cooper and received the rudiments of an education at the college in his native town, and in 1828 entered a printing office as proofreader. While in this position he acquired considerable ability as a linguist, and published (1838) a work on French grammar of such merit that he was awarded a pension by the Acad. of Besançon. In 1840 he published a work on political economy "Qu'est-ce que la propriété?", in which he advanced the radical theory that "property is theft." This and other works caused him to be prosecuted, but he was ultimately acquitted. From 1843-47 he superintended a water transport system at Lyons on the Saone and Rhone Rivers. He settled in Paris in the latter year, and became a leader of the Revolution of 1848, publishing an aggressive journal which advocated extreme democracy and socialism. His paper was suppressed by the government, but he was chosen by a large vote as a representative in the constituent assembly from the department of the Seine. The radical views he expressed caused a majority of the members to seek to suppress his views by making disturbances during his addresses. However, he reached the masses by publishing three daily papers in Paris, and in 1849 was imprisoned for three years on the charge of inciting insur-

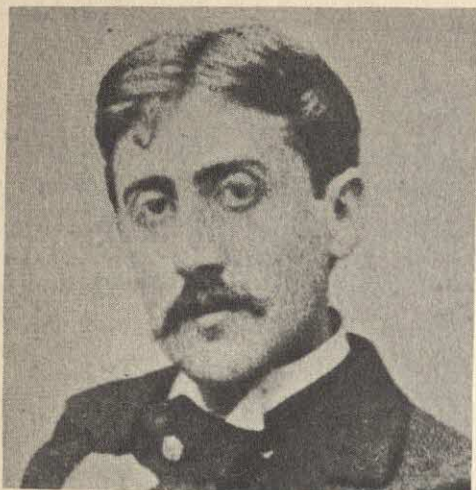


PIERRE JOSEPH PROUDHON

rections. In 1852 he regained his liberty and settled in Belgium, where he continued publishing addresses and works on political and economic reforms. Among his writings are "De la création de l'ordre dans l'humanité" and "Système des contradictions économiques." Proudhon was influential as a writer and speaker, and his fines and many of his expenses were defrayed by popular subscription. He argued that labor alone should receive the product of labor, and that there was no justification for the existence of rent and interest. The state, he maintained, must be destroyed because it was founded on the concept of property.

Proust (*proost*), **MARCEL**, author, born July 10, 1871, in Paris, France; died there Nov. 18, 1922. The son of a professor of medicine, Proust studied at the Lycée Condorcet from 1882-89. A private income enabled him to spend the next 15 years indulging his enjoyment of fashionable society. In 1905, after the death of his parents, he secluded himself in a soundproofed apartment in Paris. It was here that he planned and wrote his 15-volume lifework. He did not actually begin to create until he was 43, having previously published only two unimportant translations. In 1914, however, he began his monumental masterpiece, "Remembrance of Things Past," which was gradually published, part of it posthumously. The novels which make up the work include: "Swann's Way," "Within a Budding Grove," "The Guermentes Way," "The Cities of the Plain," "The Captive," "The Sweet Cheat Gone," and "The Past Recaptured."

Proust's work, which came to have great influence not only on literature but on the general thinking of the whole world, is characterized by the high sensitivity of the author toward his surroundings and by a tremendous descriptive power. He was able to mirror the most subtle



MARCEL PROUST

Courtesy Brown Bros., N. Y.

sensations of all the senses, not only of sight and sound, but also, for example, of smell. While these qualities had been introduced in French literature by Stendhal (1783-1842), Proust's acute psychological observation and self-observation extended modern man's conscious awareness of himself. The relationship between man and his social environment and the mutual influence of the two on each other were of utmost importance to Proust.

Provençal (*prô-vân-sâl'*), the name used to designate the different Romanic dialects formerly spoken and written in the south of France, which are employed at present by country people in the region included in the former province of Provence. Collectively they are classed as one of the six chief Romance or neo-Latin languages and sometimes as a dialect of French. Provençal is inflected more than the other dialects of its class and was the first to be fixed grammatically. The earliest writings in the Provençal language date from the 9th century, and in the 11th and 12th centuries its literature spread over a large portion of southern France and into northern Italy and Spain. Its widest use and highest development were reached in the latter part of the 12th century. The highly inflectional properties make it particularly adaptable to the production of poetic forms, though in modern times it is more simply inflected than in the ancient, and a considerable number of French words and terms have been incorporated with it. Provençal literature was revived in the 19th century.

Provence (*prô-vân's'*), a former French maritime province, bounded on the n. by the Dauphine, e. by the Alps and Italy, w. by the Rhone River, and s. by the Mediterranean Sea. *Provincia*, part of Roman Gaul, gave the territory its name. Overrun by Visigoths and Burgundians in the 5th century, most of Provence was attached to

PROVERBS

Cisjuran Burgundy in 879 and in 1032 passed to the Holy Roman Empire. In 1482, it was annexed by France, but retained its autonomous assembly until 1639. In 1789, Provence became the three departments of Bouches-du-Rhône, Basses-Alpes, and Var, to which Vaucluse was added in 1793 and Alpes-Maritimes in 1860. Several of Daudet's (*q.v.*) novels celebrate the region.

Proverbs (*pröv'ërbz*) are brief, pointed, general expressions of folk-wisdom. A true proverb is not only very general in its application, but is also widely known and widely used among the people of the region in which it is current. Although many collections of proverbs have been assembled and published, and although they have been subject to a good deal of study, proverbs are not usually of literary origin. They rise among the people because of their applicability to the activities of daily life.

Proverbs are often figurative. They usually draw their metaphors from common daily activities and observations. Such homely sayings as the following illustrate the characteristics of proverbs: The burnt child fears the fire. Half a loaf is better than none. A new broom sweeps clean. Birds of a feather flock together. Don't count your chickens before they are hatched. Haste makes waste.

Because of their very general applicability, the same or strikingly similar proverbs often appear in a great many regions and a great many languages.

Proverbs (*pröv'ërbz*), **BOOK OF**, one of the books of the Old Testament. Probably added comparatively late, it represents a compilation from various sources and, although it is possible that some of Solomon's sayings are preserved therein, it is surely not a collection of the sayings of Solomon. As a whole, it is secular and its connection with the religious contents of the Old Testament is somewhat artificial. It belongs to the "wisdom" literature, which we encounter in the Old Testament, and also generally in the literature of ancient people. There are Egyptian books of wisdom before the 15th Dynasty (*ca.* 1900 B.C.) and there are early Greek wisdom books. The Jewish wisdom books, which collect "mashals," contain short, didactic condensations, discourses, aphorisms, and allegories, and only exceptionally what we call a proverb or a folk-saying. Thus, the only unifying idea in the book is that its sayings give advice for practical life in society and for human behavior toward our brethren. The collector of the sayings assumes that the cardinal social virtues are the guiding principles in our life.

The Book of Proverbs is a canonical—not a prophetic—book and does not pretend to be inspired directly by God. Many of its sayings are taken over from the wisdom of neighboring

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peoples; Egyptian sayings are often clearly traceable.

The Book refers to daily life and clearly indicates that the life of the time in which it was compiled is daily city life and not the country life of the early Jews. This fact alone sufficiently proves that its sayings could not have been selected before 350 or 300 B.C. Its strong philosophical character shows the influence of the intellectual contact with the world of Greek philosophy. Theologians have published scholarly works of research on the origin of various groups of sayings and even of single sentences, and it has become clear that some of them are of earlier, some of later origin. As a whole, they were certainly not edited before 350 B.C. and probably not later than 150 B.C.

Providence (*prōv'i-dēns*), a city and port of entry in northern Rhode Island, capital and largest city of the state, seat of Providence County, located 44 m. s.w. of Boston at the head of Narragansett Bay. It is served by the New York, New Haven and Hartford R.R. Theodore Francis Green Airport, at Hills Grove, is 7 m. from the center of the city.

DESCRIPTION: Covering an area of 17.9 sq. m., the city is plainly divided into the business section on a level plain, and the residential area, located on hilly sections to the north and east. Important business streets are Westminster and Weybosset, running in a generally east-west direction. Many streets on the colonial East Side bear such names as Benefit, Benevolent, and Hope. The city's parks and playgrounds cover 790 acres. Roger Williams Park (442 acres), in the southwestern part of the city, is the largest. The nearby residential area on Narragansett Bay is an important tourist center. The Quonset Point Naval Air Station and the Naval Construction Battalion Center at Davisville are both about 15 m. from the city.

Points of interest include the Arcade (1828), sole survivor of the "temples of trade" built at that time; First Baptist Church (1775), mother church of American Baptists; First Unitarian Church (1816), housing the largest bell ever cast by Paul Revere; the Protestant Episcopal Cathedral of St. John; the Roman Catholic Cathedral of SS. Peter and Paul; John Brown House (1786); and old State House (1762), where Rhode Island declared its independence on May 4, 1776, two months before the other colonies.

COMMERCE: Providence is an important center of wholesale and retail trade; in fact, 70 per cent of the state's population lives within a 10-m. radius of the city. Among the city's major manufactures are jewelry, silverware, machinery and machine tools, fabricated metals, textiles, instruments and optical goods, and rubber goods; printing and publishing are also important. The



Courtesy Adler's, Providence, R.I.

VIEW OF PROVIDENCE FROM COLLEGE HILL

city is part of the Providence-Pawtucket, R.I.-Mass., standard metropolitan statistical area (pop., 1960, 816,148), which includes parts of several counties. The city produced a value added by manufacture of \$294,410,000 in 1958.

EDUCATION: The annual enrollment in the public schools is ca. 28,750; in the parochial schools, ca. 10,000. Institutions of higher learning include Brown Univ.; its affiliate, Pembroke Coll. for Women; the Rhode Island School of Design; Providence Coll.; Rhode Island Coll. of Education; Bryant Coll. of Business and Administration; and Roger Williams Junior Coll. Cultural institutions include the John Carter Brown Library and Pendleton House, a museum exhibiting an extensive collection of early American furniture, which is part of the Museum of the School of Design.

GOVERNMENT: The government is headed by a mayor and 26 council members, elected biennially.

HISTORY: Providence was founded in 1636 by Roger Williams, who in 1643 received a patent of incorporation of "Providence Plantations in the Narragansett Bay in New England," uniting Providence with Portsmouth and Newport. Providence was burned in 1676, during King Philip's War, but afterwards changed from a community of planters to one of commerce and industry. After the American Revolution it surpassed Newport in population and attained such a degree of wealth that property valuations nearly trebled between 1782 and 1800. It was incorporated as a city in June 1832.

POPULATION: In 1810 the population was 10,971. The greatest growth occurred between 1840 and 1850 when the population increased from 23,172 to 41,518. It exceeded 100,000 for the first time in 1875, and continued to grow, but declined (due to the expansion of suburban areas) from 253,504 in 1940 to 248,674 in 1950. In 1960 the population was 207,498.

Provincetown (*prōv'ins-toun*), a town in Barnstable County, Massachusetts, on the tip of Cape Cod, 47 m. N.E. of New Bedford. It was

settled in 1620 as the first landing place of the Pilgrims, who there drew up the Mayflower Compact. The town was incorporated in 1727. Once a whaling station, its chief industry is now fishing. The tourist trade is extensive and includes many artists every summer. It is the seat of the Cape Cod School of Art and the Provincetown Players. Population, 1950, 3,745.

Provo (*pró'vó*), a city in Utah, seat of Utah County, on the Provo River, ca. 45 m. s. of Salt Lake City. It is on the Denver & Rio Grande and the Union Pacific R.R.'s. The center of an agricultural area, it has packing plants, flour mills, steel plants, and brickyards. Brigham Young Univ. is located here. It is a summer resort; nearby Utah Lake, Provo Canyon, and Bridal Veil Falls are popular tourist attractions. Settled (1849) by Mormons, Provo was chartered in 1851. Population, 1950, 28,937.

Proxy (*prók'si*), a piece of writing by which a person is authorized to act for another, especially in political and conventional matters. It is a common practice, where a delegate cannot act, to authorize another to act and vote in his stead in a convention. This is also commonly applied in business matters, as in corporations, to authorize some other member to represent one or more members by proxy. Proxy may also refer to the person designated to act as an agent, or substitute.

Prunes (*prōnz*), the dried fruit of any one of several species of the common plum. Prunes are produced extensively in California, Oregon, and southern Europe, and are known in the market from the country producing them, as California, Spanish, German, Turkish, and French prunes. They are used extensively as a food, after being prepared by stewing, and in some countries brandy is distilled from them.

Pruning (*prōon'ing*), the act of cutting off superfluous branches, shoots, or roots of trees and shrubs for the purpose of bringing the plants to a particular form, or with the view of strengthening the growth of the parts remaining. Many plants throw out unprofitable growths, thus decreasing the production of flowers and fruit, while some assume a form either undesirable or ill suited to withstand the effect of wind and weather. The ultimate result of judicious pruning is an increase in the vitality of the plant and in the size and quality of its fruit. This result is due to the removal of excessive branches, thus exposing the inner limbs to a greater amount of sunlight and causing a larger quantity of vital sap to flow to the flowers and fruit. In some countries forest trees are pruned with the view of influencing the growth of their trunks as to size and direction, while in flower culture plants are trimmed to increase the size and vigor of their ornamental parts. *Root pruning* is generally ef-

fective to increase the beauty and size of flowers. Both classes of pruning depend upon the plants to be improved, since the removal of a large number of roots and branches may impair general growth. Pruning out of season is particularly harmful.

Prussia (*prüsh'a*), in German, *Preussen*, formerly the largest constituent of Germany. Until the defeat of Germany in World War II, it was divided into the following provinces: East Prussia, West Prussia, Brandenburg, Pomerania, Silesia, Saxony, Schleswig-Holstein, Hanover, Westphalia, Hesse-Nassau, Rhineland, and Hohenzollern. Silesia was the largest province, area 15,568 sq. m., and Hohenzollern was the smallest, area 441 sq. m. The total area was 134,548 sq. m. Berlin was the capital and largest city. Other cities of importance included Breslau, Cologne, Danzig, Düsseldorf, Frankfurt, Königsberg, Magdeburg, Altona, Stettin, Krefeld, Aachen, and Halle. In 1947 Prussia was dismembered and the various parts were distributed among newly established administrative units called *Länder*.

DESCRIPTION. The western part of what was Prussia is rather hilly and mountainous, but the general surface of the vast territory lying toward the north and east is level or undulating. The principal rivers of this territory include the Rhine, Weser, Elbe, and Oder. The principal rivers have been improved for navigation by a network of canals and there is adequate railway service. Formerly the region was covered by a vast expanse of forests, and about one quarter of the surface is still covered with timber. Much of the soil is exceedingly fertile, though in some portions marshes and peat bogs are extensive, while in others the soil is light and sandy, as in the case of former East Prussia and West Prussia. The Rhine Valley is noted as the most picturesque and fertile part of Germany. It is famous for its fine orchards and vineyards.

INDUSTRIES. Farming remains one of the leading enterprises of this region. Among the products are wheat, barley, oats, maize, potatoes, sugar beets, garden produce, flax, and hemp. The raising of domestic animals is an important enterprise. Mining is a major industry, the products including coal, peat, iron, zinc, lead, copper, cobalt, silver, salts, copperas, manganese, and nickel. Among the manufactures are beet sugar, tobacco products, cotton and woolen goods, scientific instruments, and machinery. Before World War II, it had a vast trade in textile fabrics, chemicals, metal wares, leather, glass, stoneware, timber, and livestock. The leading port cities were Stettin, Flensburg, Königsberg, Kolberg, Stralsund, Kiel, on the Baltic, and the North Sea port of Altona. The Ruhr (*q.v.*) district, one of Europe's most important industrial areas, lies in this region.

EDUCATION. The educational institutions of

Prussia gained world-wide fame. Attendance at all the public elementary schools was compulsory. Noted universities were at Berlin, Halle, Göttingen, Königsberg, Greifswald, Münster, Breslau, Kiel, Bonn, and Marburg. The State Library at Berlin was Prussia's leading library.

INHABITANTS. The earliest inhabitants were the pagan *Pruzzen*, who were subjugated by the Knights of the Teutonic Order of St. George in the 13th century. They encouraged German colonization in Prussia and were responsible for the start of cities such as Danzig, Marienburg, and Königsberg (now Kaliningrad). Later events brought about the entry of Poles, who, throughout the region's history, were the principal minority. The last population figure for Prussia as an entity was 41,762,040, in 1939.

HISTORY. It is thought that when the Phoenicians visited the North and Baltic Seas, in the 4th century B.C., they found Slavonic tribes occupying the region at present comprised in northern Prussia, but little is known of these people until the 10th century, when they are mentioned by a number of writers as *Borussi* or *Porussi*. Their fear of losing independence caused them to battle against the advance of Christianity with marked determination, and in 997 Bishop Adalbert of Prague was martyred by them. The Teutonic Order of St. George converted them to Christianity in the middle of the 13th century. A considerable part of modern Prussia was governed by the Teutonic Knights until 1466 (Peace of Thorn), when their power was overthrown by the Poles. The Teutonic Order embraced Protestantism and its land was converted into a secular duchy (1525), under the rule of its chief knight, Albert of Brandenburg. Albert, at the same time, was invested with the duchy of Prussia under the Polish king. Frederick William, known as the Great Elector, established Prussia as a European power after the Peace of Oliva (1660), which freed Prussia of Polish authority.

Prussia was a noted seat of action in the Reformation. It was connected more or less prominently with the early German Empire that included Austria and Italy, and took a large part in the contests that led to the overthrow of Napoleon in 1815 after it had been all but dismembered by the French emperor. Prussia was established as a world power in 1866, when it undertook an aggressive movement against the power of Austria, which not only consolidated many of the German states with Prussia, but ultimately resulted in the organization of the German Empire after the Franco-Prussian War of 1870-71, the Prussian king assuming the title of Emperor of Germany; thereafter the history of Prussia is that of Germany (*q.v.*). However, in the course of the Allied occupation of Germany after World War II, Prussia as an entity ceased to exist.

Prussic Acid (*prüs'sīk ās'īd*), a colorless liquid discovered by Scheele in 1783, known scientifically as hydrocyanic acid or cyanide of hydrogen. It has a specific gravity of .7, boils at 80° F., and solidifies at 5°, forming feathery crystals. Prussic acid is obtained from many sources, including the kernel of the bitter almond and the fruits of the peach and apricot families. It is derived from the leaves of the cherry, laurel, and peach and from different parts of various plants.

Prut (*prōot*), a tributary of the Danube River, rising near the boundary of Galicia and Hungary, on the northeastern side of the Carpathian Mts. After a course of about 500 m. toward the southeast it joins the Danube at Galatz. It forms the boundary between Rumania and Russia, has a deep valley, and is navigable to Jassy.

Przemysl (*pshē'mīsh'l*), a city in Poland, in Galicia, on the San River, 50 m. s.w. of Lwow. It is the seat of a Roman Catholic and a Greek Catholic bishop, and has a cathedral built in the 15th century. It is a railway and trade center. The Russians captured it in March 1915, but lost it soon after. It also was a battlefield in World War II. Population, ca. 300,000.

Psalms (*sāmz*), book of, a book of the Old Testament, containing the songs of praise used by the Jews in their worship in the temple. It contains 150 psalms, or sacred lyrics, and was arranged by the Hebrews in five books, each having a particular superscription and terminating with a doxology. It is evident that the book was compiled from many sources over many centuries. Some writers have attributed it almost entirely to David, but others think that Solomon wrote a number of the psalms. It is certain that some were written after the Babylonian captivity, and others in the time of the Maccabees. The New Testament contains many references to the Psalms.

Psaltery (*sól'tēr-ē*), an ancient musical instrument. See *Dulcimer*.

Pseudonyms (*sū'dō-nīmz*), fictitious names assumed by writers or actors to conceal their identity. They are frequently called *noms de plume*, French for "pen names." The practice of publishing books and magazine articles under false names originated with persons who, for reasons of modesty, did not care to be spoken of in connection with their publications. Many young authors have used pseudonyms because they did not wish to risk revealing their identity, and later the assumed names clung to them and became more widely known than their real names. This is particularly true of such writers as Marian Evans, D.R. Locke, William Sydney Porter, and Samuel L. Clemens, who are better known by their respective pseudonyms, *George*

Eliot, *Petroleum V. Nasby*, O. Henry, and Mark Twain.

Psittacosis (*sīt-à-kō'sīs*). See *Parrot Fever*.

Psittacus (*sīt'ā-kūs*), the genus parrot, although in recent classifications the term has been restricted to the common gray parrot and some of its relatives.

Psyche (*sī'kê*), in Greek mythology, the youngest of three princesses, whose beauty excited the jealousy of Venus and so attracted those with whom she came in contact that she was often mistaken for Venus. After observing for some time the popularity of Psyche, Venus sent Cupid, or Love, to inspire her with admiration for the most contemptible objects. However, Cupid himself soon became enamored of her and his passions were fully reciprocated by the maiden. The nightly visits of the two lovers attracted the attention of the two jealous sisters of Psyche, who prevailed upon her to fear that she was in courtship with a monster. Although it had been previously understood that the maiden should not inquire regarding the personal affairs of Cupid, she was so aroused to curiosity that on one occasion she carried a lamp to the chamber of her lover, in whom she discovered the handsomest of gods. In the excitement that followed Cupid was awakened from his sleep, only to reprove her for her doubts and vanished from her sight. Later Psyche and Venus became fully reconciled, and the two lovers were united in immortal wedlock with the sanction of Jupiter. Writers have generally regarded the story of Psyche as personifying the human soul in its progress through the afflictions of life until immortal peace is realized.

Psychiatry (*sī-kī'ā-trī*), the branch of medicine which deals with the recognition and treatment of mental disorders, that is, with disturbances of attitude, personality, and behavior. Derived from the Greek words *psyche* (mind, spirit, soul) and *iatreia* (healing), psychiatry was a purely descriptive specialty until about 50 years ago. Since then it has undergone a tremendous experimental and clinical development, so that at present greater emphasis is being placed on treatment. This new dynamic psychiatry is based on *psychopathology*, or the study of abnormal mental processes.

Some psychiatric illnesses are accompanied by organic disease of the nervous system, that is, pathological changes visible to the naked eye or with the microscope—for instance, syphilis, arteriosclerosis, or tumor of the brain. Others are purely functional or psychogenic, that is, originating within the mind without visible changes in the brain—for instance, psychoneurosis or paranoia. Still others are sometimes placed in one group or the other, for instance, schizophrenia. By contrast, *neurology* treats symptoms of disease of the nervous system, such as apoplexy, paralysis,

or tremors, in which there are usually few mental disturbances but always abnormal changes in the brain or spinal cord. However, these two specialties are so frequently linked by concomitant nervous and mental symptoms that they are jointly designated by the term *neuropsychiatry*.

The symptoms of mental disorders are many and varied, but the following are among the most frequently encountered. *Hallucinations* are perceptions of sights, sounds, or odors which do not really exist, although they seem very real to the patient. *Illusions* are misinterpretations of existing ideas or phenomena, which the patient refers to himself. *Delusions* are imagined but fixed ideas of persecution, jealousy, grandeur, illness, or sin, without a real or with only a coincidental factual basis.

Obsessions or compulsions are ideas which continually obtrude themselves against the patient's will with or without external cause, the content of which is usually recognized as incorrect. *Speech* disturbances may consist of too-rapid speech, refusal to speak at all, too rapid shifting from one subject to another unrelated subject, or repetition of the same word, phrase, or nonsensical word. Similarly, *disorders of movement* may consist of too-rapid movements of the arms and legs, constant running around, or refusal to move at all, or keeping any position in which the limbs may be placed. The *emotions* or *mood* may be disturbed—for instance, laughing or crying without reason, or lack of reaction to pain, or dulling of emotion so that the patient may speak of pleasant or horrible experiences without showing pleasure or fear. *Personality* and *behavior* changes are often seen; the patient may act as if he were someone else, or even two different persons, or a friendly person may become suspicious and asocial. *Memory* and *orientation* defects may appear so that the patient will not know his name, age, or where he is; *amnesia* is the term used for loss of memory. Although all mental disorders show themselves by these symptoms, the complete picture of the illness depends on the previous personality of the patient.

The classification of psychiatric disease is based generally either on the predominant symptoms or on the causative agent. Unfortunately, terminology varies from one country to another. In America, a standard classification and nomenclature have been adopted by the American Psychiatric Association.

Psychosis is a profound mental disorder in which all or most of the faculties of adaptation to environment are disrupted, i.e., social, religious, intellectual, and emotional, with subsequent disorganization of the personality. The psychotic loses contact with reality. This may or may not be accompanied by organic changes in the brain. The most important psychoses are: *Schizophrenia*

(a splitting of the personality, also called *dementia precox*), of which several varieties are characterized in addition by hallucinations, ideas of persecution or grandeur, and disturbances of movement; *mania*, an agitated state, with overactive body movements, rapid flow of ideas, and continuous talking; *melancholia*, the opposite state, with depression, inactivity, unwillingness to speak, and self-accusation for imagined wrongdoing; *manic-depressive psychosis*, consisting of alternating periods of mania and melancholia. Other psychoses which always have visible changes in the nervous substance, are caused by acute infections, alcoholic overindulgence, drug addiction, and brain tumors. The term *insanity* and the adjective "crazy," popularly used by the lay public but of little significance to the psychiatrist, refer to the psychoses.

By contrast, the *psychoneuroses* or *neuroses* are personality disorders in which there is no visible disease process in the brain or part of the body which appears ill. They are really a defense mechanism or outlet by which conflicts between the restrictions of society and hidden instinctive, emotional, or sexual desires and experiences, may find solution. These then manifest themselves as apparently unrelated mental and physical symptoms. These patients retain contact with reality and have insight into the fact that something is wrong with them; this is one of the characteristics distinguishing the neuroses from the psychoses. They may have unreasonable fears (*phobias*), or the urge to repeat certain acts such as washing the hands (*compulsions*), or bothersome thoughts which cannot be dismissed from the mind (*obsessions*), or extreme nervousness with trembling and sweating (*anxiety*), or paralysis. The neurosis may also show itself by difficulties in adjustment: inability to hold a job, marital disharmony, inadequate sexual satisfaction or even sexual perversions, extreme aggressiveness or timidity, feelings of failure or undue ambition, and many others. A neurotic person is not insane but he is ill; his symptoms are not imaginary, they are very real, and can cause intense suffering, unhappiness, and disability.

By *dementia* is meant a reduction of the intellectual faculties, previously normal, to a childish or infantile level. Some of these patients even have to be fed and "changed." This condition is sometimes seen as a result of an untreated psychosis, or in old age. *Feeble-mindedness* or mental deficiency refers to a low level of intelligence and understanding in a person whose physical age is greater than his mental age. This mental age is easily determined by standard intelligence tests (such as those used by psychiatrists in the army or in schools). According to degree of intellectual development, these persons are classified as *idiots* when their intelligence is less than that

of a child two years old; as *imbeciles* when less than a child of seven; and as *morons* when less than a child of 12. This arrested development of the mind is usually present from birth, in which case it may be either inherited from weak-minded parents or due to a birth injury. It is frequently accompanied by malformations of the brain, head, or body, such as cleft palate or undescended testicles. However, it may follow malnutrition, deficient thyroid function (known as *cretinism*), congenital syphilis, or infection of the brain, all during childhood.

Psychosomatic medicine (*soma* = body) is an increasingly common name for a branch of psychiatry although its concepts have been known to physicians for a century. It deals with physical illnesses referable to some body organ, with physiological disturbances therein, not stemming from disease of that organ but rather from pent-up unconscious conflicts or emotional tension. Also included are conditions where there is a slight real disease of some part of the body, but in which psychic tension aggravates the symptoms. Among numerous examples are certain types of colitis, palpitations, high blood pressure, hyperthyroidism, menstrual pain, and asthma.

The importance of neuropsychiatry as a social and economic problem can hardly be underestimated. Nervous and mental disease occupies third place as to frequency among all diseases in the U.S., with approximately 1,500,000 cases per year, hospital and ambulatory patients included. According to the latest statistics of the Federal Census Bureau, there were (1940) 604,000 hospital beds for these diseases, with a 94.8 per cent occupancy. During 1939 and 1940 there were 217,000 new admissions per year. This totaled 295,000,000 patient-care days and a cost to the government of over \$210,000,000 per year. The number of cases of mental disorders rises sharply during periods of mental uncertainty, such as during the depression of 1929 and the two world wars. Selective Service statistics show that 1,750,000 (about 12 per cent of the draftees) were rejected during World War II for neuropsychiatric reasons. In addition, about 524,000 more were discharged for similar conditions developed while in the service, or about 43 per cent of all casualties.

The development of psychiatry has paralleled the degree of enlightenment of the various periods of history, and of the prevailing concept of mental illness. During the Middle Ages the reigning ignorance and superstition caused the mentally ill to be tortured and killed in the belief that they were possessed by the devil. Even after the establishment of asylums in the 16th and 17th centuries, patients were placed in chains and dungeons along with hardened criminals, and subjected to brutal and degrading treatment. In 1793, the French psychiatrist, Pinel, and the Eng-



PSYCHIATRIC TREATMENT DURING THE 16th CENTURY.

Painting by Pieter Brueghel the Elder (1528-69)

lish Society of Friends initiated the reform of replacing this harsh restraint by tolerance, kindness, and sympathy, or what is called moral treatment. However, it was not until 100 years later that these reforms were adopted in America, when county almshouses and jails were replaced by mental hospitals. This was largely due to the efforts of a few reformers, such as Dorothea Dix, Clifford Beers, and more recently the National Committee for Mental Hygiene. Today, every civilized country maintains psychiatric hospitals. In 1940, there were 594 such hospitals in this country, of which 392 had from 100 to several thousand beds. These account for only 8.5 per cent of all hospitals, but for over 50 per cent of all hospital beds. Of this latter group, 59 per cent are government hospitals (state or Federal), 9.7 per cent are non-profit group-owned and government-licensed, and 31.3 per cent are privately owned.

The law permits admission to one of these hospitals by one of several ways. The patient may sign a voluntary admission form without court proceedings, or if under 21 his parents can sign. He then retains all legal rights, and may leave on request if he is not dangerous. An emergency commitment is a temporary psychiatric observation of an acutely ill patient on request or petition of a responsible relative, which must be certified by an authorized qualified mental specialist (two in some states). A regular or legal commitment requires in addition that a judge of a court of record formally commit the patient to a specified hospital. A hearing may be necessary to determine the patient's mental status and need for treatment.

The patient retains his legal rights to property unless the court decides to appoint somebody who

will thereafter be responsible for the patient and his estate. However, he cannot make a will, set up a business, or sign a contract unless the law provides for exception according to the degree of his responsibility and understanding. An insane person cannot be legally punished for a crime he commits, as he has no legal responsibility for his actions. If marriage is contracted by a mentally ill person, especially if his illness was concealed, the marriage can be annulled. A marriage can be legally voided if one of the parties is declared by qualified psychiatric experts to have been incurably ill for a certain number of years. If a wife is mentally ill, the husband must guarantee her maintenance for life. An alien who develops an incurable mental illness within five years from the date of entry to the U.S., and who becomes a public charge, may be deported.

The treatment of mental disorders has taken enormous strides during the last 50 years. Before that, psychiatry was static, concerning itself chiefly with the description and classification of the various illnesses. Since then, the discovery of new methods of chemical and physiological analysis of the nervous system, and the formulation of the dynamic concept of psychic function, have introduced new methods of therapy.

The psychiatrist Sigmund Freud (*q.v.*) discovered the method of *psychoanalysis* (*q.v.*) to treat certain types of neuroses. He found that his patients had involuntarily hidden emotional or sexual desires and experiences, usually present from childhood, of which they were consciously unaware. In other words, depending on the attitudes of their parents or other significant persons in their environment, children will react with various emotions. Any of these which might be forbidden or tending to create feelings of guilt, will

be *repressed* or pushed out of the mind and forgotten. Instead of disappearing, however, they remain in the subconscious—or the mind of which we are unaware—extremely active, and affect our personalities and adult patterns of reaction. Constantly striving to express themselves, these elementary, primitive forces conflict with the restrictions imposed both by our consciences and by the conventions of everyday life. Whenever a situation might arise resembling the original childhood situation, without the person realizing the association, it would tend to produce anxiety or other symptoms of the neurosis. The conflict cannot be solved by the patient unaided, not only because of the lack of recognition of its cause, but also because the illness relieves the guilt feelings and satisfied the patient's unconscious desire for sympathy. The psychoanalytic treatment consists of bringing out the hidden or subconscious desire or experience into the patient's realization, of explaining how the physical symptom symbolizes this hidden force. The conflict can then be resolved consciously and the patient adjust himself to life. Other psychiatrists, particularly Alfred Adler, Carl Jung, Adolf Meyer, Harry Sullivan, and Karen Horney, have since modified certain principles after finding that all patients did not respond to the original Freudian techniques. These authors have variously rejected some of Freud's ideas, such as the inherited instinctual nature or the exclusively sexual nature of some of the child's emotions. They have emphasized other aspects of the personality, such as the sentiments of inferiority-superiority, or the non-sexual interpersonal relationships of the child, or the biological-social characteristics, or the secondarily developed neurotic personality traits resulting from simultaneous conflicting inner drives. However, many of Freud's basic concepts are generally accepted.

Inasmuch as psychoanalysis is inherently a long and expensive method of treatment requiring a relatively high level of intelligence, its application is limited to a proportionately small number of patients. Therefore many psychiatrists prefer to use other methods of *brief or directive psychotherapy* also embodying the exposure and interpretation of hidden conflicts but adding more active explanations, reassurance, and guidance.

Hypnoanalysis is the technique of having the patient bring to light these conflicts while he is hypnotized, as in that condition he makes less voluntary mental resistance. *Narcoanalysis* is the use of narcotic drugs injected into a vein to induce a hypnotic-like state, during which the patient will express his hidden thoughts. This method was much used during the war to treat certain neuroses developed in soldiers or civilians as a result of terrible mental tension.

Electroshock is a treatment especially successful in certain types of melancholia and depressive psychoses. It consists of passing an extremely small but accurately measured and controlled electric current through certain parts of the brain. *Insulin shock* is a method of producing a very deep sleep by injecting insulin to use up the sugar in the brain; the patient is awakened when he is fed sugar. This treatment helps many cases of schizophrenic psychosis. The shock treatments bring about their curative action on the mind apparently by a combination of psychological and physiological effects. Psychologically they seem to satisfy the unconscious desire for punishment, thus easing guilt feelings. Physiologically, they have been shown to alter the metabolism of the nervous system.

Some types of agitation are cured by the *continuous sleep* treatment, whereby the patient is put to sleep for one or two weeks by sleep-producing drugs, being awakened only to eat and take care of his natural needs. *Hydrotherapy*, consisting of prolonged baths at body temperature, is also used to relax excited patients. *Occupational therapy* is the assigning of suitable work to the patient under medical direction. It acts by stimulating depressed patients or by diverting or concentrating the interest and attention of psychotic patients. Much of its benefit is due to the satisfaction derived from completion of a task, however simple it may be.

One of the newer methods of treatment is the use of operations on the brain or *psychosurgery*. This therapy has been found successful in many chronic cases of schizophrenia, severe change-of-life depressions and obsessive states, where all other methods of treatment previously used had failed. The operations consist essentially either of separating the front of the brain from the rest, or of excising certain small areas of the brain surface (prefrontal lobotomy or *topectomy*). This results in a lessening of the distressing emotion connected with these mental conditions, in a decrease in the agitation, and in a gradual disappearance of the abnormal fixed ideas, without affecting the intelligence or memory. Most of these patients previously requiring long hospitalization are able to return to a relatively normal, well-adjusted home life.

Prevention of mental disorders is as important as their active treatment, particularly in the stress of modern life. This can be achieved by the prophylactic practice of *mental hygiene*. This science deals with the principles of mental health, which demand the development and application throughout life of habits, thoughts, and actions conducive to personality stability. It thus involves every phase of social environment from the cradle to the grave; family surroundings of the infant, child guidance, juvenile sex education, delin-

quency, harmonious adaptation to married life, social and economic aspects of old age.

The passage by the U.S. Congress in 1946 of the National Mental Health Bill made possible a National Neuropsychiatric Institute and a National Advisory Council to implement a program which would attack the psychiatric problem at its source instead of concentrating entirely upon the end-result. In addition to providing for coordinated research into the causes, prevention, diagnosis, and treatment of neuropsychiatric disorders, this legislation stresses the training of personnel at the prophylactic and care levels, the development of out-patient and prophylactic clinics, and a constructive program of public education. See also *Neurology*; *Psychology*, and separate articles on individual physicians referred to in this article.

Psychoanalysis (*sī-kō-ā-nāl'ŷ-sīs*), a method of psychiatric treatment and of psychological research developed by the Austrian physicians Josef Breuer (1842-1925) and Sigmund Freud (1856-1939), and based on certain observations concerning the mental process and motives of behavior. Psychoanalysis postulates a continuous conflict between the conscious will and the subconscious or suppressed tendencies or desires, particularly sexual. Persons with excessive psychic conflicts or repressions develop "complexes" such as fear, anxiety, obsessions, and compulsions which bring their minds out of balance. Dreams constitute one of the principal means by which the subconscious can be scrutinized, and by which the patient can be assisted in evoking his subconscious thoughts. It is the task of the physician who practices psychoanalysis to help his patient uncover this portion of his mind, since awareness of the cause of conflict can aid in overcoming it.

Alfred Adler, Carl Gustav Jung (*q̄q.v.*), and others developed the basic Freudian theory in divergent directions.

Psychology (*sī-kōl'ō-jŷ*), the scientific study of the functioning of the living organism (especially man), considered as a unit, adjusting to other individuals and to the world around it. It includes the chief emphases of both the biological and the social sciences. As a science it stands midway between physiology on the one hand, and sociology and cultural anthropology on the other.

Though the roots of psychological speculation are to be found even in the lore of primitive tribes and contemporary folklore, and recorded analyses of human behavior are often traced back to the early Greeks, modern psychology, as a science, may be said to have been founded in the physiological laboratories of Germany in the early 1800's. Pre-experimental psychology represented chiefly the efforts of the philosophers to grapple

with the problem of the human mind and the relation of mental to physical events. Descartes, Spinoza, and Leibnitz, in the 17th century, outlined approaches to these problems which dominated much of the thinking of the 18th and 19th centuries. Other philosophers, such as Hobbes, Locke, Berkeley, Hume, and Hartley, contributed to the attempt to work out a systematic background for the understanding of man's functioning and helped pose the problems which set the stage for the rapid development of the experimental study of psychological problems. As a matter of fact, it was not until the latter half of the 19th century that experimental psychology was recognized as a distinct field of scientific endeavor. Though the field of psychology has such deep foundations in folk speculation and philosophy, and has been greatly enriched by the contributions of the neurologists and psychiatrists dealing with nervous disorders, psychology today is a scientific discipline depending chiefly on experimental study.

The branch of the science known as *general psychology* is essentially the study of the normal adult human individual. Man is regarded as being a complex biological unit whose adjustments involve reaction to the environment and depend on many processes within the body, no one of which is completely independent of others. Some of these processes are popularly called mental, others physical, but scientific investigators are unable to draw a sharp dividing line between these two types of activity and are at present inclined to avoid making such distinctions.

The individual is aware of some of the processes which take place within him; these are termed conscious. Other aspects of his functioning are outside the realm of the individual's awareness; these are called unconscious or subconscious. The same material or activities may be conscious at one time and unconscious at another, depending on special conditions within the individual and the environment. The individual functions, primarily, as an integrated unit, though it is of course true that the interrelationships of some processes are much closer than those of others and that in some cases adjustments are a compromise between conflicting tendencies.

DEVELOPMENT. At conception, the fertilized ovum of the female is endowed with biologically defined growth potentials. Before birth as well as after birth, development proceeds in accordance with the process of maturation. This process establishes not only such things as the eruption of teeth and the start of walking, but also the capacity of the individual to respond to social stimulation and to acquire certain skills and techniques of control over self and environment. Growth is, however, modified by exercise as well as maturation. An individual's performance status

generally represents the resultant of both maturation and training. Careful study of the maturation process makes it possible to select the time for the introduction of training procedures when they can be most effective. Premature training tends to be inefficient though sometimes performance can be modified by it.

There are three basic processes which are important in the understanding of human behavior. These processes are motivation, learning, and perception.

MOTIVATION. The individual responds to both external and internal stimulation, the latter resulting from changes going on within the body. The organic bases of many of these internal drives are readily identified. There are, for example, the needs for air, rest, food, liquids, evacuation of waste from the body. Other drives, like curiosity, status-seeking, and even sex, are harder to localize precisely within the body. Some of these more complex drives may represent not specific organ needs, but rather the result of involved interactions of the body as a whole and of the organism and the environment. Some needs arise through learning. These are called derived needs, activities originally undertaken as ways of achieving particular goals which seem to become goals in themselves. Needs at times are aroused by features in the environment. Some such features are incentives, others may be emotion-arousing situations. The latter are situations which give rise to pronounced bodily changes of feeling, surprise, or upset.

The *affective processes* include emotions and feelings and refer to those experiences which include pleasantness or unpleasantness, tension or excitement. Though the intensity of such experiences gives them a subjective clarity, as a field of study they have not as yet yielded to a completely satisfying analysis. The very young child seems to show simple excitement in situations which older observers interpret as emotion-arousing. Later, two types of responses are observable, an approach pattern and a pattern of withdrawal. With further development, still greater differentiation can be observed until the very complex adult series of emotions are shown. Learning plays an important role in establishing what kinds of situations provoke emotional responses and in defining the patterns of emotional expressions. The search for a body center of the emotions has revealed that three parts of the nervous system play exceedingly important roles. These parts are the autonomic nervous system, the hypothalamus, and the cerebral cortex.

Most needs may be satisfied by any one of a large range of behaviors. Man's hunger drive may be satisfied by foods ranging from snakes and snails and skunks to steaks medium-rare; man's sex behavior ranges from celibacy to promiscuity,

with homosexuality and varieties of heterosexual perversions also occurring. The broad limits within which man's needs may be satisfied are, of course, biologically defined. But particular cultures commonly delimit some segment of the range and then an individual's life history in that culture defines his personal ways of satisfying his needs. After sufficient experience of gratifying needs in particular ways, the range within which the need can be satisfied becomes narrowed down for the individual, and he becomes so canalized that his need can be satisfied only within a very narrow segment of the original range. The ways in which needs are satisfied by special forms of behavior may be specified by forms of learning other than canalization, for example, by conditioning.

LEARNING. An adequate understanding of human nature is possible only when the modifiability of the organism is understood. Man has an inherited capacity for growth and a physiological basis for the dependable motives. However, the specific ways in which motives are satisfied are subject to profound change based on learning.

The study of the learning process has stemmed from the British associationist philosophy, with experimental refinement of the early laws of association which were used to explain the sequence of thoughts in the mind. As originally stated, there were four laws of association. Contiguity in time, contiguity in space, similarity, and contrast defined the establishment of an associative bond between "mental elements." Contemporary analysis emphasizes the single unifying principle that for two items to be associated, they must be experienced together. These primary laws of association describe the conditions under which associations are formed. Secondary laws of association call attention to those features which establish the relative strengths of associative bonds. The secondary laws of association include reference to the factors of recency, frequency, and vividness of the original experiences. The interest of educators led to the study of the relative effectiveness of rewards and punishments. Research has demonstrated that reward is more potent than punishment in promoting learning and that either is more effective than an absence of such special motivation.

Other major developments in the study of the learning process have proceeded from the early researches of the Russian physiologist, Pavlov (*q.v.*), on the conditioned response. The process of conditioning involves the adaptation of the organism so that a stimulus, originally inadequate for the production of a given response, becomes adequate. This is achieved by presenting the originally inadequate stimulus along with a stimulus adequate for the response sufficiently often and under appropriate conditions. The orig-

inal experiment involved ringing a bell at the same time food was given to a hungry dog. After a number of such presentations, the bell alone was sufficient to start a flow of saliva. Though much research has been done in this field, and it clearly involves analysis of the establishment of connections on a physiological level, no completely satisfactory biological explanation of how conditioning occurs has as yet emerged.

PERCEPTION. The interaction of the organism with the environment is mediated by the reaction of our sense organs, specialized parts of the body which respond to different types of physical stimuli. These receptor organs provide the bases for the senses of sight, hearing, taste, smell, skin sensitivity (touch, pain, warmth, cold), equilibrium, and kinesthesia (muscle and joint movement). The effective nature of the environment is not defined by the precise sensory impressions one receives, for the organism spontaneously organizes such impressions and responds in terms of these organized perceptions or object-meanings. The nature of the organized percepts determines the manner in which component parts are interpreted. The whole is more than the sum of its parts, the whole determines its parts. Much of our understanding of the organizing processes involved in perceiving comes from the *Gestalt*, or Configurationist, school of psychology. See also *Gestalt Psychology*.

Principles of perception emphasize the organized nature of the response. Primarily the organization is one of figure and ground (focus and background). In well-structured situations, the stimulus pattern will define the way in which the figure-ground relationships will be seen (or heard, felt, etc.). Patterning will be influenced by such factors as nearness in space or time, similarity, continuity, closure (tendency to complete an incomplete figure), habit, set or attitude of the observer, general context. In loosely structured situations where the objective stimuli are unclear or poorly organized, internal factors, personal motivations, play a dominant role in patterning the percept. This fact gives us a basis for accounting for diversity of understanding and opinion on complex social, economic, and political issues—the material is so complex that it may be structured in a variety of ways, and prejudices and personal points of view sensitize the individual to those aspects of a situation which are congruent to the attitudes he already holds.

HIGHER MENTAL PROCESSES. When the ability of the organism to respond to symbolic cues (words, for example), and the availability of imagery ("mental sensations"—for example, the ability to hear a tune running through your head or to see a picture in your "mind's eye") are added to the functions of motivation, learning, and perceiving described above, the nature of the higher

mental processes can be understood. Thinking involves perceiving with an emphasis on the mental manipulation of symbols. Imagining consists of making new patterns mentally of previously observed percepts or experiences. Internal motivations such as desires and wishes may play a greater part in directing imagination than the objective external situation. Inventing is the kind of thinking which involves the establishment of new perceptual patterns or new solutions in response to the needs of special problems. See also *Intelligence Tests*.

PERSONALITY. The integration of an individual's characteristic ways of behaving, his values, attitudes, interests, his abilities and aptitudes, represents his personality. Many efforts to divide mankind into a variety of personality types have been made, none of which have been found to meet the test of controlled research by independent students of the problem. Studies of a large number of specific traits of personality and character have resulted in the general finding that people tend to be distributed in accordance with the "normal distribution curve" (bell-shaped, bilaterally symmetrical, with most people clustered about the middle of the scale, and progressively fewer found as the extremes are approached) rather than to be distributed in accordance with a type-theory. Psychiatrists dealing with personality disorders have contributed many fruitful hypotheses to the scientific students of personality. Among the more prominent of these psychiatric approaches are Freud's *psychoanalytic theory*, Adler's *individual psychology*, Jung's *analytic psychology*. The study of personality has also been enriched by the contributions of the Gestalt psychologists, by those concerned with research into physiological function, especially of the glands, and by the studies of the anthropologists which have given valuable insights into the nature of human personality as developed in radically differing cultures.

In addition to general psychology, the principles of which have been described above, the science includes a number of other branches and fields of specialized application. *Differential psychology* is concerned with the analysis of group and individual differences, and the general field of mental testing. It is this branch which has contributed so greatly to the development of tests of intelligence and other special abilities. These tests are important in diagnosing individual potentialities and aid in adjusting school problems, in personnel selection, and in vocational guidance. In connection with the latter application, tests of interest, aptitude, achievement and personality are used to assay an individual's temperament, interests, and abilities.

Social psychology is the branch that is especially concerned with the analysis of the bases of

social interaction, social attitudes, the behavior of individuals in a group situation, and the effects of social stimulation on the individual. Studies of the ways in which prejudices are learned, public opinion, propaganda analysis, techniques for social re-education, are all illustrative of the applications of this branch of the science.

Child psychology specializes in the study of the developing individual, the behavior of the newborn, and the way in which the course of development contributes to the adult patterns. *Abnormal psychology* is the systematic study of the mentally disturbed and of the feeble-minded. The functioning of these abnormal individuals is compared with that of the normal with increased understanding of both. *Comparative psychology* undertakes the analysis of the psychology of all levels of life from the simplest to the most complex. It involves a study of the principles common to all animals and of those principles which stand in special relationship to the evolutionary sequence.

There are, in addition, a number of fields for the application of psychology, for example, Psychology of Aesthetics, Psychology of Ethics, Educational Psychology, Industrial Psychology, Vocational Psychology, Clinical Psychology.

Psychoneurosis (*sī-kō-nū-rō'sis*). See *Psychiatry*.

Psychopathology (*sī-kō-pà-thōl'ô-jy*). See *Psychiatry*.

Psychosis (*sī-kō'sis*), in medicine, an abnormal mental disposition caused by a pathological function of the brain. It is not, however, identical with insanity. See also *Psychiatry*.

Psychosomatic Medicine (*sī'kō-sô-mât'ik mēd'i-sin*). See *Medicine*; *Psychiatry*.

Psychotherapy (*sī-kō-thēr'â-pi*). See *Psychiatry*.

Ptarmigan (*târ'mi-gan*), the name of several species of grouse, differing from the other birds of the same family in that the legs are densely feathered to the claws and the nasal grooves are covered with feathers. They have 16 to 18 feathers of considerable length in the tail. In most of the species the feathers become white in winter. They inhabit the northern and snow-covered regions of both hemispheres, where they feed on mosses, lichens, small fruit, and insects. The plumage harmonizes with the rocky barrens in summer and the snow in winter, and the plumed feet enable them to walk upon the snow without sinking into it. About June the female incubates, but the male assists in rearing and feeding the young. Both fly rapidly with a whirring noise and are swift runners. The females cackle like a hen, but the males have a loud, harsh cry. Two species, the *rock ptarmigan* and the *Welsh ptarmigan*, are widely distributed in North America. The former is seen in Greenland and both range far north in Canada.

PT Boat (*pē tē bōt*), abbreviation for patrol torpedo boat. See *Torpedo Boat, Motor*.

Pteridophytes (*tēr'i-dō-fits*), one of the four orders into which the nonflowering plants are divided, including the ferns, scouring rushes, and club mosses. They are associated with the seed plants, since they are larger in size and display a larger growth of foliage than the moss plants. The general name *cryptogams* is applied to all plants that do not bear seed, and so the pteridophytes are frequently termed *vascular cryptogams*. They do not possess a stem, but have real roots. About 4,500 species have been described. The greater number of these plants is tropical.

Pterodactyl (*tēr-ô-dāk'tīl*), the name of a genus of extinct flying reptiles, which lived in the Mesozoic or Reptilian age. They included a large number of species and are usually classed as bird lizards or wing lizards. It is presumed that they did not precede the birds, since they appear to have originated from dinosaurian ancestors. These animals had skeletons with hollow bones, fitted to fly, but exceedingly strong, and large teeth were set firmly in the jaws. Later species seem to have lost the development of teeth, but in these the jaws were larger and more powerful. In the larger forms the wings had a spread of 20 ft. and some of the species were exceedingly powerful both in water and while flying, though they were less favorably adapted to move about upon the dry ground. The skin seems to have been smooth and uncovered, since no traces either of scales or feathers have been found. Fossil remains are widely distributed, especially in the limestone formations of Europe.

Ptolemy (*tōl'ê-mī*), the name of a dynasty of Egypt, which ruled that country from 323 to 30 B.C. These kings were of Grecian origin and succeeded to the throne of Egypt when that country formed one of the divisions into which the empire of Alexander the Great was divided. Ptolemy I, surnamed Soter, upon the death of Alexander in 323 B.C., became ruler of Egypt, which nominally remained a satrapy of Macedonia. He is the founder of the great library of Alexandria, and during his reign was built the lighthouse on the island of Pharos. His son, Ptolemy II, succeeded him in 285. He and his successors of this line of kings are noted as patrons of learning and art, the founders and defenders of Greek culture in Egypt. Cleopatra, who belonged to this line, ruled jointly with Ptolemy XIV, her brother, surnamed Dionysus, from 61 to 47 B.C., when a Roman army under Caesar defeated Ptolemy XIV, who was drowned while attempting to escape. The line became extinct with Ptolemy XVI, who was the son of Cleopatra by Julius Caesar. He reigned conjointly with his mother from 45 until 30 B.C., but was put to death by Octavius after the Battle of Actium.

Ptolemy, CLAUDIUS PTOLEMAEUS, Greek geographer and mathematician, flourished in Alexandria, Egypt, in the 2nd century A.D. It is thought that he was born at Ptolemais, a Grecian city of the Thebaid, and that he published the results of his astronomical and geographical observations in 139 A.D. Some writers assign a number of discoveries to him as late as the year 161, though it is certain that his chief work, "*Megale Syntaxis tes Astronomias*," was published at an earlier date. This work is known among the Arabs as "*Almagest*," meaning *the greatest*, and includes some of the most valuable early discoveries in astronomy. The "*Geographike Hyphegesis*" is a noted geographical work in eight books, besides which he published a catalogue of fixed stars and a number of treatises on astrological subjects. He maintained in his "*Almagest*" the *Ptolemaic system* of astronomy, which was so named because he was its most eminent expounder.

The theory of Ptolemy assumes that the earth is a fixed body, remaining constantly at rest in the center of the universe, with the sun and moon revolving around it as attendant satellites. The more complicated movements of the planets were represented by a contrivance illustrating each planet as revolving in a great circle called a *deferent*, while within the great circles revolve the centers of small circles called *epicycles*, the latter immediately surrounding the planets, and each member of the system having its own deferent and epicycle.

Ptomaine (*tō'mān*), the name of certain poisonous substances found in animal matter while in the state of decay. It resembles in its properties the vegetable alkaloids. The ptomaines are the products of microbes.

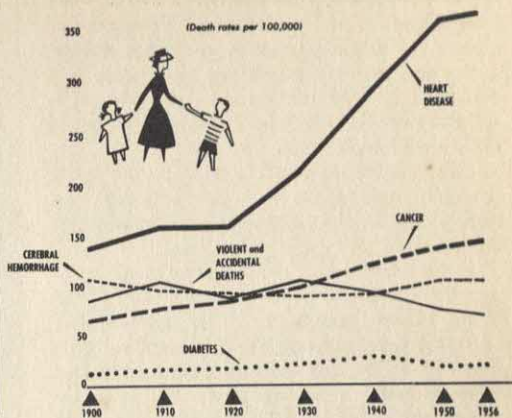
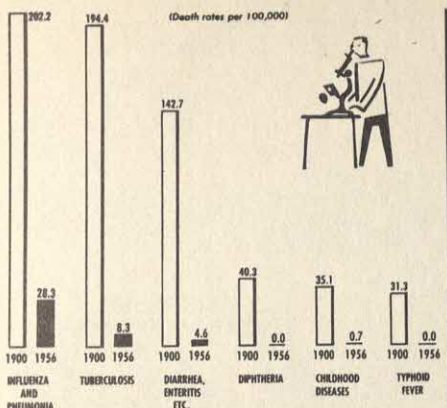
Puberty (*pū'bēr-tī*), the age in humans (between childhood and adolescence) of the development of the powers of reproduction. This period develops at about the 13th year or just before in females, and slightly later in males; however, the onset may vary between the 11th and 17th years in both sexes, depending on race, climate, environment, hereditary factors peculiar to the parents, and nutrition and general health of the individual. Contrary to widespread belief, puberty begins at an earlier age in the vigorous temperate and cold climates than in the physically depressing warmer climates. In the female puberty is indicated by: (1) the onset of ovulation (extrusion of the egg cell from the ovary into the fallopian tube which guides it into the uterus, or womb) and of menstruation (the periodic sanguinous discharge from the female genital tract in which the unfertilized egg cell is cast off) in regular cycles; (2) by the maturation of the external genitalia and enlargement of the breasts; (3) by rounding and filling of the body contours; (4) by growth of pubic and axillary hair; (5) voice changes,

and (6) awareness of her sex as not previously noted. In the male the distinctive changes are: (1) increased muscular development with sudden interest and pride in physique; (2) maturing of the external genitalia; (3) growth of pubic and axillary hair and appearance of a downlike beard, and (4) deepening of the voice, with frequently embarrassing squeaks and croaks which if ridiculed too much by others may lead to deep-seated resentment and withdrawing tendencies and sometimes to permanent personality effects. Essential to bringing about the changes of puberty are certain hormones (internal secretions). The gonadotropic hormone from the pituitary gland stimulates the development of the gonads (primary reproductive organs—ovary in the female and testicle in the male) which in turn start producing the sex hormones (estrogen and progesterin in the female and testosterone in the male) which are responsible for the maturation of the genital organs and of the secondary sex characteristics of the body form. Psychologically, individuals of both sexes become for the first time distinctly aware of both their own and the opposite sex at the pubertal age, and considerable curiosity is aroused. The boy shows new interest in girls which he often tries to hide because of pride or lack of comprehension of these changes in himself. The girl shows signs of emergence of the maternal instinct. Intelligent education, advice, and companionship by parents are essential in helping the child at puberty to understand himself and his natural functions in order to reach maturity with a rational outlook. Ignorant misconceptions of the simple facts, acquired at this age, may lead to unhappiness and personality defects later in life. See also *Child Guidance*.

Pubis (*pū'bis*), in anatomy, the lower frontal end of the bony pelvic structure.

Public Health Service (*pū'b'lik hēlth sēr'vīs*), in the U.S. includes various local government agencies such as those administered by the city, county, or state, but major activities in this field are centered in the U.S. Public Health Service of the Dept. of Health, Education, and Welfare. The service had its actual origin in 1798, when Congress created the Marine Hospital Service for the "relief of sick and disabled seamen." The Public Health Service engages in extensive health programs in co-operation with states, other Federal agencies, governments of foreign nations, and international agencies. Its affairs are administered by the Surgeon General, with Assistant Surgeons General in charge of designated administrative bureaus to which are delegated specific functions. Officers of the regular corps of the Public Health Service are commissioned by the President, with the advice and consent of the Senate, after passing an examination in one of the several branches of medicine—dentistry, sanitary engi-

GREAT GAINS HAVE BEEN MADE AGAINST MANY OF 1900'S LEADING CAUSES OF DEATH



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neering, pharmacy, nursing, or related scientific specialties. Some specialized professional positions are filled by civil-service employees.

The Public Health Service operates by assistance and co-operation, largely through demonstrations, advice on technical matters, and loan of officers to state and local health departments and to other Federal agencies. The greatest assistance is given through financial grants to state and territorial health agencies for expansion and improvement of their programs.

The broad powers and duties of the Public Health Service are delineated in the Public Health Service Act of 1944, as amended. Outstanding functions of the service are:

(1) Study of the causes and means of propagation and spread of the diseases of mankind, and the development of methods of prevention and control. In this work, the Public Health Service maintains several research laboratories, chief among which are those of the National Institute of Health, including the National Cancer Institute. In addition, financial assistance is given, through research grants, to universities, laboratories, and other public and private institutions for research projects. Funds are also available for research fellowships, both in the institute and in various university medical schools.

(2) Maritime quarantine and inspection of passengers and crews of vessels and airplanes arriving from foreign ports, for the protection of the country from the importation of quarantinable diseases from other countries; also examination of immigrants, in collaboration with the Immigration and Naturalization Service of the Department of Justice, for detection and isolation of persons suffering from mandatorily excludable diseases.

(3) Interstate quarantine for prevention of the spread of diseases from state to state. The Federal

health agency prescribes conditions under which persons and things may move in interstate commerce. It assists states in controlling epidemics and may, on request, take complete charge of serious outbreaks.

(4) Dissemination of public health information, including collection and publication of reports of disease prevalence in the U.S. and foreign countries, and other pertinent information regarding conservation of the public health.

(5) Assistance, through grants to states, counties, cities and health districts, in establishing and maintaining proper sanitation facilities; also, aid to general public health services—including industrial hygiene, mental hygiene, and cancer control—and special programs for the control of the venereal diseases and tuberculosis. Services include the loan of personnel for temporary duty, also the provision of consultation and advice to state and local health departments.

(6) Supervisory control and licensure, to insure safe and standard products, of the manufacturers of biological products—vaccines, serums, toxins, antitoxins, arsenicals, etc.—used in the prevention and treatment of diseases.

(7) Study of mental diseases and drug addiction and investigation of legitimate needs for narcotic drugs.

(8) Provision of hospitalization, general medical and dental care, and preventive health services for American merchant seamen, for members of the U.S. Coast Guard and the Coast and Geodetic Survey, and for other legal beneficiaries of the service. In this connection, the service operates 24 marine hospitals and 115 other medical relief stations, and contracts for service with 133 hospitals in places not served by marine hospitals. It assigns medical and dental officers to ship duty to provide medical and dental care at sea for the Coast Guard and Coast and Geodetic

PUBLIC UTILITY

Survey. The Public Health Service also maintains a medical and health program in Federal prisons in cooperation with the Bureau of Prisons. The medical division of the Office of Indian Affairs is staffed by Public Health Service officers on detail to that organization.

(9) Operation of special hospitals, namely, the National Leprosarium and two hospitals specifically for the care of mental patients and persons addicted to the use of narcotics.

(10) Administration of a wartime nurse training program in accordance with provisions of the Bolton Nurse Training Act. This law provided for recruitment and training of nurses, through grants to institutions offering training for students in basic nurse education, and refresher courses; also in postgraduate education, including intensive short courses.

(11) Cooperation with other Federal agencies in discharging their various health functions, through assignment of personnel for assistance.

(12) Participation in the organization and subsequent functioning of international health organizations, with particular attention to the direction of programs for the exchange of international health and related personnel, and for supervision of health missions to foreign countries.

(13) Collection and publication of data on vital statistics, which are basic materials for public health programs and give valuable information concerning public health trends.

Public Utility Holding Company (pŭb'lik ũ-tĭl'i-tĭ hōld'ing kŭmp'ā-nĭ). See *Holding Company*; *Securities and Exchange Commission*.

Public Works Administration (pŭb'lik wŭrks ād-min-ĭs-trā'shŭn) (PWA). See *United States*.

Puccini (pōōt-chē'nē), GIACOMO, composer, born in Lucca, Italy, Dec. 22, 1858; died in Brussels, Belgium, Nov. 29, 1924. Born of a long line of musicians, Puccini studied music in his home town, and achieved recognition with his first composition, "Capriccio sinfonico" (1883). Encouraged by this success, the young composer went to work on his first opera, "Le Villi." This was produced the following year at Milan, and Puccini was now embarked upon the career which was to make him one of the most popular operatic composers of his day. His sweetly fluent melodies, his rich musical invention, his limpid but colorful orchestration, combined with a keen sense of dramatic values, gave his operas an appeal which insured their success with the public. They epitomized in many ways the entire school of Italian operatic music just before and during the turn of the century. Another element in Puccini's success was undoubtedly the quality of emotional appeal in the librettos he chose for musical presentation. The story of "Manon Lescaut," which had a triumphant premiere in 1893, was taken from



GIACOMO PUCCINI

a popular novel by Antoine Francois (Abbé) Prévost. It is interesting to note that the success of Puccini's work was not lessened even by the fact that it offered competition to the opera "Manon," based upon the same novel and written by the highly esteemed Massenet nine years earlier.

The production of "La Bohème," in Turin (1896), with Arturo Toscanini conducting, confirmed an earlier pronouncement by George Bernard Shaw that Puccini was the "true successor to Verdi." This romantic opera, adapted from a French novel and drama, has been for many years a staple of operatic repertoire in many countries, containing as it does some of Puccini's most popular arias. Its Metropolitan debut in New York was on Dec. 26, 1900, with Nellie Melba singing Mimi; since then it has been performed at the Metropolitan more than 200 times, with the leading roles taken by singers such as Giovanni Martinelli, Lucrezia Bori, and Antonia Scotti. "La Tosca" (1900) was also an immediate success, but the premiere of "Madama Butterfly" in 1904 provided Puccini with his first experience in adversity. This opera was based upon a play by David Belasco and John Luther Long; with its Oriental theme, and the two long acts in which it was written, it proved too much of a novelty for the La Scala audience at Milan. It was not until three months later, after the opera had been revised and restaged in three acts at Brescia, that it received the acclaim which was its due. In 1905 "Madama Butterfly" was given a spectacular premiere in London, with Emmy Destinn, Enrico Caruso, and Antonio Scotti. In the U.S. the leading roles have been sung, among others, by Geraldine Farrar, Caruso, Scotti, Elizabeth Rethberg, and Suzanne Fisher.

A world-famous composer now, Puccini was invited to New York to direct the first Metropolitan Opera House production of "Manon Lescaut," with Caruso and Scotti in the principal male

roles (Jan. 18, 1907). The success of "Madama Butterfly," presented a month later, established Puccini as a favorite with Metropolitan opera-lovers. Inspired by American interest, he based his next opera, "The Girl of the Golden West," upon a play by David Belasco, American playwright and producer. This opera was well received upon its opening night, Dec. 10, 1910, but never achieved the popularity of Puccini's other works, even in America. At the time of the composer's death he was at work on a second opera with an Oriental background—China this time. After his death in 1924, this opera—"Turandot"—was completed by the Italian composer, Franco Alfano, and given its premiere in 1926 with Toscanini conducting. Its reception added new laurels to Puccini's long record of success as a composer of melodic and appealing romantic opera in the Italian style.

Puck (*pūk*), or ROBIN GOODFELLOW, the name applied in England to a fairy. It corresponds to the *Knecht Ruprecht* of Germany, the *Nisse* of Scandinavia, and the *Brownie* of Scotland. Shakespeare employs *Puck* as a prominent figure in his "A Midsummer Night's Dream." Writers generally regard the term as applicable to all species of sportive fairies which are capable of serving in domestic relations, but generally characterized by their jovial and merry pranks. However, in "Piers the Plowman," it denotes the devil (*pouke*); Spenser, in his "Epithalamion," called Puck an "evill spright." They are represented in literature as of small stature, affectionate to the beautiful, mischievous to the housemaids, and easily induced by kindly gifts to serve in performing many household duties.

Puebla (*pwā'blā*), a city of Mexico, capital of the State of Puebla, 68 m. S.E. of the City of Mexico. It is located on a fertile plain about 7,000 ft. above sea level, has railroad connections, and is the center of a large trade in agricultural produce and manufactures. It has many noteworthy buildings, including the museum, the theater, several colleges, and a splendid cathedral. Onyx is mined near the city. The manufactures have long been among the most important of Mexico. They include cotton and woolen goods, boots and shoes, glass, leather, soap, earthenware, and machinery. The city was founded in 1532 by the Franciscans. Santa Anna made an unsuccessful effort to capture it in 1845 and Maximilian captured the city on May 17, 1863, after a siege of two months. Population, 1940, 137,324.

Pueblo (*pwēb'lō*), county seat of Pueblo County, Colorado, on the eastern slope of the Greenhorn Range of the Rocky Mts. Communication is furnished by the Missouri Pacific, the Colorado & Southern, the Denver and Rio Grande, and the Atchison, Topeka & Santa Fe R.R.'s. It is the second largest city of the state and one of

the most prosperous cities between the Rocky Mts. and the Missouri River. Among the noteworthy buildings are the county courthouse, the city hall, the McClelland Library, the State Hospital for the Insane, and many fine schools and churches. The City Park and the Mineral Palace Park are among the public resorts.

Pueblo is in about the center of the Arkansas Valley of Colorado, an extensive irrigated area; there are 50,000 acres of irrigated land in Pueblo County. The principal products are livestock, dairy products, poultry, sugar beets, alfalfa, flour, garden and field seeds, cantaloupes, melons, corn, wheat, oats, onions, fresh vegetables, and fruits.

Pueblo is within 25 m. of the San Isabel National Forest (614,000 acres). Many mountain peaks are over 13,000 ft. in elevation and some reach more than 14,000 ft. Pueblo is surrounded by a region which produces an abundance of coal, gold, silver, and other minerals. It has a large wholesale and jobbing trade. The manufactures include tents, awnings, furniture, lumber products, bread, brick, tile, farming implements, mining machinery, hardware, and earthenware. Railroad shops and a steel plant are also important. The vicinity was first settled by the Mormons in 1846. The settlement soon became a trading post; laid out in 1859, it was incorporated in 1873. Population, 1950, 63,685.

Pueblo Indians (*pwēb'lō in'di-anz*) comprise the agricultural village-dwelling Indians of the Rio Grande Valley of New Mexico and of the desert plateau of northeastern Arizona. They were discovered by Spanish explorers in 1540 and originally numbered about 30,000 people.

The Pueblos form four distinct linguistic groups: (1) Shoshonean, confined to the Hopi (*q.v.*) villages in Arizona; (2) Zunian, of Zuni (*q.v.*) Pueblo, New Mexico; (3) Keresan, including the Pueblos of Acoma, Cochiti, Laguna, San Felipe, Santa Ana, Santo Domingo, and Sia in New Mexico; and (4) Tanoan, comprising the divisions of Tiwa, Tewa, and Jemez near the Rio Grande. Some 13,500 Pueblo Indians live in New Mexico and 3,500 in Arizona.

Pueblos, the villages of the Pueblo Indians (*q.v.*). Often built into the side of a cliff or on top of a mesa, they may resemble apartment houses. An important feature is the kiva, or ceremonial chamber, which may be underground.

Puerperal Fever (*pū-ēr'pēr-al fē-vēr*), in medicine, an infection of the uterus after childbirth which leads to fever. Due to the progress of antiseptics, both the incidence and the mortality rate of puerperal fever, once quite high, have been much reduced. See *Sammelweis*, Ignaz P.

Puerto Rico (*pwēr'tō rē'hō*), COMMONWEALTH OF, formerly PORTO RICO, an island of the West Indies, the smallest and easternmost of the four which comprise the Greater Antilles; it is a self-



Courtesy Puerto Rico News Service

RURAL SCENE IN PUERTO RICO

governing commonwealth freely associated with the U.S., 1,000 land m. S.E. of Miami and ca. 500 m. N. of Caracas, Venezuela. The island is rectangular in shape, 100 m. long by 35 m. wide, excluding several smaller islands off the coast which are considered part of Puerto Rico. The total land area is 3,423 sq. m. Economically, it is the fastest growing area in the Caribbean, with per capita income now second only to oil-rich Venezuela in Latin America.

DESCRIPTION: Puerto Rico's geographical profile is similar to the *pava*, the hat worn by farm workers in the hills. The island's interior is crowned by two mountain chains—the Cordillera Central and Sierra de Luquillo—whose pyramid-shaped slopes drop off sharply near the coast to form the plain which completely rings the island. The highest peak is Cerro de Punta (4,390 ft.), in the south central region. El Yunque (3,404 ft.), in the northeastern corner of the rectangle, is best known for its junglelike vegetation and as a spectacular tropical rain forest on U.S. soil. The Atlantic Ocean laps the island's north shore and the Caribbean Sea rolls in from the south. The deepest part of the Atlantic Ocean is the 30,180-ft. chasm called the Milwaukee Depth, just 105.8 m. N.W. of Puerto Rico. The island is, in fact, a mountain peak surrounded by subterranean valleys.

Because Puerto Rico lies in lat. 18° N., the subtropics, palm trees and wild flowers bloom the year round. Bamboo grows along the roads and

streams. The flamboyán tree, the African tulip, *trinitaria*, and scarlet hibiscus are bright contrasts to the year-round green of the countryside. Despite its semitropical location, there are no poisonous snakes or wild animals on the island.

Although there are many swift rivers flowing north and south down the mountains, few are navigable beyond their mouths. The rivers join the sea to form harbors at San Juan, Arecibo, Mayagüez, and Ponce. Rivers and streams are harnessed by the Insular government for irrigation of the southern coastal plains and for the production of electric power throughout the island. Average yearly rainfall varies markedly every few miles. It approximates 60 in. annually in San Juan. The sun shines part of 360 days every year. There is no rainy season, though precipitation is greater during the summer months. At sea level, the mean winter temperature is 73.4°, and the summer average is 78.9°. In the mountains, temperatures are from 5° to 10° lower. During the months from November to April, strong trade winds blow and the humidity is much lower than in summertime. Although the island is in the hurricane zone, it has suffered only two severe storms in the past 25 years. The island's nearly perfect climate and natural scenic beauty make it a tourist favorite. About 160,000 tourists visit Puerto Rico every year.

TRANSPORTATION: Most of Puerto Rico's connection with the mainland is by means of water transportation, although three major airlines maintain passenger and cargo service between Puerto Rico and the States. Other airlines connect the commonwealth with the Caribbean, Central and South America, and Europe. Steamship lines connect Puerto Rico with North America, South America, and Europe. In addition, small craft ply between neighboring islands of the Caribbean. Railroad mileage totals 472 and highway and road mileage, ca. 4,000.

AGRICULTURE: Up to 1956 the soil provided the greatest single source of income and employment in Puerto Rico, but the island's "operation bootstrap" industrialization program has changed the picture completely. There are 1,789,539 acres of farmland but only 745,795 acres of fertile cropland. Three-quarters of this is under intensive cultivation employing a high percentage of fertilizer. The bulk of Puerto Rico's foodstuffs must be imported from the continent, however, amounting to ca. \$145,000,000 annually.

Sugar cane, the island's biggest crop, is grown on 300,000 acres of the best farmland. Coffee covers the second-largest land area, followed by varieties of local starch vegetables and citrus fruit. Originally, the island was heavily timbered with cedar, ebony, sandalwood, laurel, palms, and other useful trees, and the forest area is still extensive. However, farming and stock raising

have encroached considerably upon the timbered districts. Cattle are grown for meat and dairy purposes. Other domestic animals include horses, sheep, mules, hogs, and poultry. The sections which are not suitable for cultivation furnish a fine growth of nutritious grasses.

In an average year, Puerto Rico exports about 1,000,000 tons of sugar to the U.S., under quotas set by the Federal government. Of the gross farm income, earnings from sugar represent 60 per cent. In addition to sugar, the island's major agricultural exports are tobacco and rum.

INDUSTRY: the island's foremost industrial products are straw hats, cigars, plastics, plywood, candy, glass, cement, and leather goods. Operation bootstrapped, inaugurated in 1947, has changed the island's economy from that of a predominantly agricultural economy to a mixed economy. As a result of the program, hundreds of U.S. manufacturers have opened branches on the island, and in 1956—for the first time in Puerto Rico's 400-year history—industrial income exceeded that of agriculture. Within ten years, 37,000 new jobs were created, and the commonwealth's net income doubled, reaching over \$1,600,000,000. The program is directed by the Economic Development Admin., which maintains offices in key U.S. cities. To attract U.S. industry the E.D.A. offers tax exemption, help in training workers, low-cost factory space, etc. Firms, to be eligible, must establish additional plants in Puerto Rico; they cannot merely relocate their facilities.

Up to mid-1955, Puerto Rico attracted mainly such light-to-medium operations as textiles, apparel, electronics, plastics, and metal fabrication. Then, however, two oil refineries and a fertilizer plant were opened, and a petrochemical enterprise and a new industry which would process paper from bagasse—a sugar-cane by-product—were under construction.

Based on these developments, economists predicted that Puerto Rico would have a \$1,500,000,000 heavy industry by 1965, which would all but erase unemployment, which currently amounts to 15 per cent of the working population. The island's imports totaled ca. \$532,000,000 in 1954;

and its exports to the U.S. amounted to \$406,000,000 in 1956, a record year.

MINERALS: Generally, Puerto Rico has few natural resources. There is a great deal of sand, limestone, gravel, and clay, but deposits of manganese, iron, copper, and lead are sparse.

POPULATION: The total population of Puerto Rico was 2,256,000 in 1956, 80 per cent of whom were white. Seventy per cent of the population live in the hills, in the open country, or in towns under 25,000 in population. The largest city is San Juan, the capital, situated on the northern coast. The metropolitan area has a population of nearly 490,000. Ponce, on the south shore, has ca. 70,000, and Mayagüez, on the west, ca. 55,000. Most of the people speak Spanish, but English is one of the official languages. Roman Catholicism is the predominant religion, and the people of that faith maintain a number of parochial schools. Protestant churches are located in San Juan, Ponce, Mayagüez, and a number of smaller towns.

EDUCATION: Since 1899 school attendance has been compulsory. There are elementary and junior high schools in rural and urban areas, and senior high schools in more than 30 towns. One unique type of school is the second unit rural school, in which vocational work is offered to all students over 13 years of age. Spanish is generally used, but English has been introduced into the school system. The government also maintains at Río Piedras and Mayagüez the Univ. of Puerto Rico. The university includes schools of the humanities, social sciences, natural sciences, education, law, pharmacy, business administration, public administration, agriculture, and mechanical arts. With Columbia Univ., it maintains the School of Tropical Medicine in San Juan, and it also runs an agricultural experiment station. In fiscal year 1957-58, education received the largest single amount of the island's budget—\$55,000,000, or more than 25 per cent of the total budget.

GOVERNMENT: Puerto Rico is a commonwealth of the U.S. under terms of a constitution which took effect July 25, 1952. The government is headed by a governor, elected by popular vote every four years, and a bicameral legislature consisting of a 32-member senate and a 64-member house of representatives, all elected by direct vote every four years. The island also elects a resident commissioner at Washington, D.C., with a voice but no vote in the U.S. House of Representatives. Judicial authority rests with the supreme, district, and municipal courts.

HISTORY: Puerto Rico became a colony of Spain shortly after Columbus stopped at the



island for water on his second voyage in 1493. He took possession for the king and queen of Spain and named Puerto Rico "San Juan Bautista." To assure the conquest, Juan Ponce de León was sent in 1508 to colonize Puerto Rico. He found there the Boriquen Indians, a docile Carib tribe, whose numbers were rapidly reduced by hard labor and disease. The Spanish conquerors discovered about \$4,000,000 in gold but had to be kept on the island by force when the gold deposits ran out. For almost three centuries, Puerto Rico was a defense outpost from which Spain tried to protect Mexico and other parts of her New World empire. In recognition of its strategic value, Puerto Rico was attacked in 1595 by Sir Francis Drake, again in 1598 by the British, who captured San Juan and held it for five months, by the Dutch in 1625, and again by the British in 1702, 1703, and 1797. The first political parties were organized in 1869 when Puerto Rico was given the status of a province in the Spanish government. Slavery was abolished in 1873, and on Feb. 9, 1898, the crown granted Puerto Rico an autonomous government. Two months later the U.S. declared war on Spain.

By the treaty of Paris, Spain ceded Puerto Rico to the U.S. A military government ruled the island until 1900, when the Foraker Act (known as the First Organic Act) established civil authority. The act also limited corporate land ownership to 500 acres, a provision which is the basis for the current land-redistribution program. The Jones Act of 1917 (Second Organic Act) made Puerto Ricans citizens of the U.S.; it also provided that the insular legislature be entirely elective. Until July 25, 1947, the President of the U.S. appointed the governor of Puerto Rico, but since November 1948 the governorship has been an elective office. On July 25, 1952, the island became a commonwealth.

The sudden upsurge of government activity in 1940 coincided with the coming to power of the Popular Democratic party, headed by Luis Muñoz Marín. In the election of 1940, the Populares, by a small margin, won control of the insular legislature. Almost immediately they enacted into law many of the reforms to which they had pledged themselves. With Muñoz Marín, president of the senate as well as of the Popular party, U.S. governors helped shape the social program. A 45-year-old precedent was shattered in 1946 with the appointment of Jesús T. Piñero as the first native-born governor of Puerto Rico. In 1948 Marín became the island's first popularly elected governor, and in 1952 a new constitution was adopted. In 1957 a unique law was enacted. Under it, the government is to pay more than \$1,000,000 every four years to the island's three political parties as insurance against big contributors who may exert a disproportionate influence on elections. Private contributions are limited to \$400

in a nonelection year and to \$600 in an election year.

During World War I, just after Puerto Ricans had attained U.S. citizenship, a considerable number of islanders enlisted in the U.S. Army. With the outbreak of World War II, the Selective Service System was extended to Puerto Rico, but, because of the high rate of enlistment, it was a full year before the draft was used. The island itself assumed great importance as the military and naval headquarters for defense of the ring of Caribbean islands protecting the eastern approaches to the Panama Canal. Puerto Rico's 65th Infantry Regiment, which gained fame in the two World Wars, also won honors in the Korean war.

Pufendorf (*pöf'ən-dórj*), SAMUEL, philosopher and clergyman, born in Chemnitz, Germany, Jan. 8, 1632; died in Berlin, Oct. 26, 1694. He first studied at Grimma and later at Leipzig and Jena. In 1661 he accepted the chair of Roman law at Heidelberg and later accepted the professorship of law of nations at Lund. In 1677 he became historian to the king of Sweden and took up his residence at Stockholm. He moved to Berlin in 1688 and remained there until his death.

"De jure naturae et gentium" (About Natural Law), which appeared in 1672, was his main work for which he is still remembered. In it, he developed the theories of Grotius and Hobbes (*qq.v.*) to the point of proving that natural law concerns only the external facts of our lives. Most important was Pufendorf's opinion that the will of the state represents only the sum of all the individuals who comprise the state.

Puff Adder (*pŭf äd'ər*), a species of poisonous serpent native to Africa but most abundant in the regions south of the Equator. The length is from 4 to 5 ft., and it is quite thick in proportion to its length. It is so named because, when irritated, it inflates the upper part of its body.

Puffball (*pŭf'bal*), the name of any fungus of the genus *Lycopodon*, so called from the shape and from its puffing out of dark-colored dusty spores when the matured plant is broken open. Puffballs grow in roundish form on the ground or on decaying wood. When immature they have a firm and fleshy interior, which later becomes a powdered mass. The spores are borne in cavities in the interior of the globular mass, and, when the surrounding tissues become dried and ruptured, the spores escape in the form of fine dust. Some species grow without a stem, while others appear at the upper part of a fleshy prominence and often acquire a circumference of several feet. Many are edible, and their fumes are used in some countries instead of chloroform for anesthetic purposes.

Puffin (*pŭf'fin*), a genus of diving birds of the auk family, native to the arctic and northern

temperate regions. The bill is deep and excessively compressed, with naked skin at the outer and back part of the mouth, and the upper mandible extends to the top of the head, both mandibles being transversely grooved. The wings, tail, and legs are short, and, like the auks and penguins, the birds sit in an upright position. Though able to fly rapidly, they cannot sustain long flights, but have much skill in swimming and diving. The puffins are migratory birds and are seen in large flocks. They feed on fish, insects, and many forms of shell life. The flesh and eggs are alike wholesome for food. Thousands of puffins may be seen in the North Atlantic and Pacific Oceans, especially in Kamchatka and the Kurile Islands.

Pug (*pūg*), the name of a small breed of dogs grown chiefly for use as house pets. The nose is short, the forehead is wrinkled, and the hair is short. Most of the full-blooded specimens have a fawn color, while the body is stout and the eyes are large. This breed of dogs seems to have been brought from the East Indies to Holland, whence it was taken to other countries.

Puget Sound (*pū'jēt sound*), an inlet from the Pacific Ocean, on the northwestern coast of Washington, which it separates from the island of Vancouver. It is the southern continuation of the Strait of Juan de Fuca and Admiralty Inlet, has a coast line 280 m. long, and contains a number of important islands and bays. Ships of the largest size may sail safely in all parts of the sound, since its shores are high, and deep water extends very near to the land. The surrounding country is fertile and richly timbered, and canal and railroad improvements have enlarged its commercial importance. The principal cities on the Sound are Olympia, Tacoma, and Seattle, all in Washington.

Pugh (*pū*), JAMES LAWRENCE, U.S. Senator, born in Burke County, Georgia, Dec. 12, 1820; died Mar. 9, 1907. He studied in Alabama, and in 1841 was admitted to the bar. He became a member of the state senate and in 1859 was elected to Congress, but retired when Alabama seceded from the Union in 1861. He was elected to the Confederate Congress in the same year and was re-elected in 1863, but served as a private in the Confederate army. In 1875 he aided in framing the state constitution and in 1880 became a member of the U.S. Senate, to which he was re-elected in 1884 and in 1890.

Pugilism (*pū'jil-iz'm*). See *Boxing*.

Pulaski (*pū-lās'kī*), CASIMIR, COUNT, patriot, born in Podolia, Poland, Mar. 4, 1748; died near Savannah, Ga., Oct. 11, 1779. He was an active opponent of Russian oppression and became leader of the Polish patriots (1768-72). He was



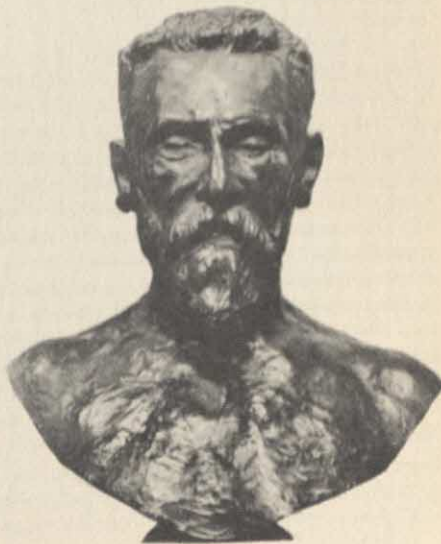
CASIMIR PULASKI

compelled to flee to France, where he met Benjamin Franklin while in Paris, in 1775. Two years later he came to America and joined the American army under Washington. Congress made him brigadier general for distinguished services in a number of engagements, particularly at the Battle of Brandywine and at Charleston and Savannah. On Oct. 9, 1779, he was mortally wounded at the siege of Savannah. He was taken on board the U.S. brig *Wasp*, on which he died two days later, and his body was buried at sea. The great elevated highway between Newark and Jersey City, N.J., is called the "Pulaski Skyway" in his honor.

Pulitzer (*pū'lit-sēr*), JOSEPH, publisher, born

JOSEPH PULITZER

Bust by Auguste Rodin (1840-1917)



in Budapest, Hungary, Apr. 10, 1847; died in Charleston, S.C., Oct. 29, 1911. He studied in his native city, but came to America while a youth, and in 1868 became a reporter on the *Westliche Post* in St. Louis, a German periodical edited by Carl Schurz. Pulitzer became a member of the Missouri legislature in 1869, supported Horace Greeley for the Presidency in 1872, and in 1884 was elected to Congress as a Democrat. In the meantime he founded the *St. Louis Post-Dispatch*, which he made a factor in state politics. His journalistic work caused him to resign his seat, giving his entire attention to the publication of the *New York World*, which he purchased in 1883. This paper had only a limited circulation, but the untiring energy of Pulitzer made it popular, profitable, and influential. He erected the tallest edifice (for its time) in New York City, the *World* building, and founded, in 1903, a school of journalism at Columbia Univ. He established the Pulitzer Prizes (*q.v.*) "for the encouragement of public service, public morals, American literature, and the advancement of education."

Pulitzer Prizes, a group of awards established by the will of Joseph Pulitzer (*q.v.*). Since 1917, Pulitzer prizes for outstanding achievement in journalism and letters have been awarded yearly on the recommendation of the advisory board of the Pulitzer School of Journalism and presented by Columbia Univ. The value of the prizes, which cover such fields as the novel, play, cartoon, U.S. history, biography, poetry, journalism, and, more recently, newspaper photography and musical composition, ranges from \$500 to \$2,000, most of the awards being \$1,000.

Pulley (*pōōl'ly*), one of the six simple machines or mechanical powers. It consists of a grooved wheel mounted in a block and is used to increase power and transmit it, by means of a rope or flexible cord, in a changed direction. The ends of the axis of the wheel are supported by a framework called the *block*, and a groove cut in the edge of the wheel prevents the rope from slipping off when it is put around the pulley. Pulleys may be *fixed* or *movable* as shown in the accompanying figures; the former are those in which the block containing the pulley is fixed, as in Figure 1, while the block in the latter class is adjusted to move with the raising or lowering of the rope, as shown in Figure 2. There is neither gain nor loss of power with a single fixed pulley; for, as the tension in every part of the rope is the same, if a weight be suspended at one end, an equal weight must be applied at the other end to maintain equilibrium. Hence, the effect of a fixed pulley is simply to change the direction of a force. However, by combining several pulleys in various ways, an instance of which is shown in

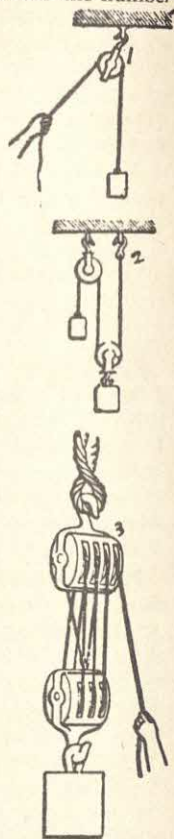
Figure 3, it is possible to gain purchase or mechanical advantage, this depending more or less upon the mode of combination and the number of pulleys utilized.

The advantage of a system of pulleys may be computed by comparing the velocity of the weight raised with that of the moving power; it may, therefore, be considered that a single movable pulley gives a mechanical advantage equal to two, or the weight may be said to be twice the power. A single fixed pulley is considered a lever of the first class, a single movable pulley is a lever of the second class, and in combinations the utility of both is more or less exemplified. In theory the advantages are increased as the movable pulleys are multiplied in combination, but advantages that would ordinarily result are to some extent overcome by the friction caused by imperfect flexibility of the ropes. This is due also in part to the friction of the pulley sheave upon its axis; this friction is now largely overcome by making the framework of iron or steel and using ball bearings for the axis.

The term *pulley* is variously applied in machinery, particularly to a wheel on which a band or belt runs for changing the direction of motion, or one in which power is transmitted to or from different parts of the machinery.

Pullman (*pōōl'man*), GEORGE MORTIMER, inventor, born in Brocton, New York, Mar. 3, 1831; died Oct. 19, 1897. He engaged in cabinet work in Albion, N.Y. (1848-55) and then became a contractor in Chicago (1855-59). In 1863 he turned his entire attention to the design and construction of sleeping coaches and in 1867 organized the Pullman Palace Car Co. The business increased with such rapidity that in 1880 he founded the industrial town of Pullman, now a part of Chicago, Ill., where the Pullman Palace Car Co. is located. Pullman also designed dining cars, and vestibule cars, by which the separate coaches of an entire train are united by connections forming safe and convenient passage to all the cars. See also *Railroads*.

Pulmotor (*pūl'mō-tōr*), a trade name for an



apparatus to induce artificial breathing, employed in cases of drowning, electric shock, and gas poisoning. The principal parts of such a device are a tank of compressed oxygen and an injector to convey diluted oxygen and air to the lungs of the patient.

Pulp (*pŭlp*). See *Paper*.

Pulque (*pōōl'kă*), a vinous beverage made in many sections of Spanish America, especially in Mexico, by fermenting the juice of several species of the agave. It is milky, resembling thin buttermilk, and has a sour taste and an ill smell to those not accustomed to its use. The maguay species of agave, also called the *American aloe*, is used mainly, since it contains the greatest amount of sugar, and the pulque is made by fermentation.

Pulsatilla (*pŭl-să-tîl'lă*), or PASQUE FLOWER, a genus of flowering plants native to Europe. The species are perennial, have bell-shaped flowers of a bluish color, and bear long, feathery awns on the fruit. The plants are narcotic and acrid. They yield a preparation known as *pulsatilla*, a medicine used in catarrhal inflammation, bronchitis, and other ailments. The flowers yield a bluish-purple coloring matter widely used in preparing Easter eggs.

Pulse (*pŭls*), the beating of the arteries, due to the passage of the blood waves caused by the successive contractions of the heart. It is noticeable, more or less, in many parts of the body in a state of poor health, but during health it is present only in the arteries, and may be felt by placing a finger lightly upon an artery running over a bone, as the radial at the wrist, or the temporal in front of the ear. The pulse varies at different ages and under different conditions. At birth the number of beats is about 40 per minute; at the end of the first year, 120; at the end of the second, 110; during middle life, between 70 and 80; and in old age, usually a little more. Males have from five to eight beats less than females. The pulsations are more numerous during excitement or exertion, but they are noticeably diminished while reclining or sleeping. The force and rate of pulsations are taken as an indication of the condition of health, but they cannot be considered reliable symptoms of a particular disease without considering other conditions. See also *Blood Pressure*.

Pultowa (*pōōl-tō'vă*). See *Poltava*.

Puma (*pŭ'mă*), or COUGAR, an American carnivorous mammal, ranging from Canada to Patagonia. It has a reddish-tawny color above and paler shades beneath. The adult is about 3 ft. high and 4 ft. long, measured from the nose to the base of the tail. The puma is an expert climber, but is not confined to the timber districts. It is seen frequently among shrubs along the

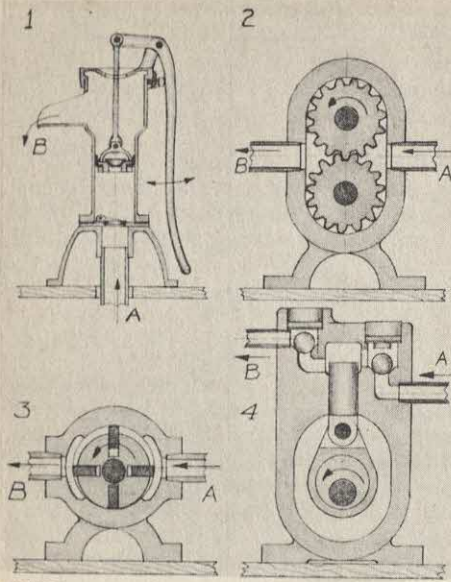
banks of rivers and on the open prairies and pampas. Like the leopard, it kills many more of the animals upon which it preys than it is able to devour, either for the sake of securing warm blood or of gratifying an instinct to destroy. Pumas prey on cattle, sheep, swine, and other domestic or wild animals, but rarely attack man. When pursued they seek safety by ascending lofty trees. The name *cougar* was first applied by the French, while the Spaniards still call it *leon*, and hunters of the U.S. know it generally as *panther*. The puma may be domesticated with little difficulty.

Pumice (*pŭm'is*), a light mineral substance of volcanic origin, formed under the action of bubbles of steam or gas which accompany lava during a liquid state. It is highly porous and may be said to be a spongy, frothlike lava. Pumice is found principally in the vicinity of volcanoes, whence it was ejected, and its color is whitish or gray, though there are slate-blue and reddish tints. Its numerous pores render it so light that it floats readily on the surface of water, sinking only after being thoroughly saturated. Pumice is obtained largely from Iceland, the Lipari Islands, at Andernach on the Rhine, and the volcanic regions in America. It is of value in polishing ivory, wood, leather, marble, bone, and metals.

Pump (*pŭmp*), a mechanism for transferring a fluid from one container to another where the fluid in the receiving container is at a higher pressure than that of the supply, or for circulating a fluid through a system where pressures are all relatively equal. If the fluid is air or a gas, the pump is referred to as a *compressor*. If the supply container of fluid is at a lower level than the pump and the discharge is open to atmosphere, the pump is referred to as a *suction pump*. If the discharge is into a region of higher pressure than atmospheric, the pump is referred to, regardless of the suction position, as a *forcing* or *force pump*.

Pumps are generally classified by their structural types as: (1) centrifugal, (2) reciprocating, and (3) rotary.

The *centrifugal pump* is generally used where it is necessary to transfer large volumes of fluid and discharge it against a relatively low pressure. The pump has one moving part, the impeller. This impeller is made up of a series of radial or spiral blades fixed on the driving shaft, fitted to rotate in a snail-shaped case. The fluid is drawn in at the center of the case and whirled around it by the impeller so that centrifugal force causes the fluid to go outward radially and press against the case, where the shape of the case causes it to collect and be discharged. No other valve is required. Such a pump with a single rotor is called a single-stage pump. If the discharge from such a stage is used as the suction of a second one, the pump be-



PUMPS

1 Hand suction, 2 gear, 3 vane, 4 rotary-reciprocating. Arrows indicate flow direction from suction A to discharge B

comes a multiple-stage unit. In this manner, by building up the number of stages, higher and higher pressures may be pumped against. Such multiple-stage units are almost universally used in forcing oil through long-distance pipe lines.

The *reciprocating pump* may be either hand or power operated and of either the "suction" or "force" variety. The common hand-operated "suction" pump has a cylindrical body with a check valve at its lower end that allows fluid to enter the body. The lever-operated piston fitted in this body has a check valve in it that allows fluid to pass through it to the space above when it is pushed toward the lower end of the body. Lifting the piston dumps the fluid above it into a discharge spout, while more fluid is sucked into the space below it through the bottom check valve. In the common "suction" pump the discharge spout is open to the atmosphere. The "force" pump has the same arrangement and operation, but its discharge spout is arranged so that the fluid can be directed through a pipe or hose into a region of high pressure. Pumps of this type have long been used for rural water supply; they are now, however, gradually being superseded by motor-driven pumps.

The commonest *power pump* is driven by steam and is widely used in power plants for supplying water to the boilers. This power unit has two double-acting cylinders fixed on opposite ends of the same shaft. One of these, the driving cylinder, is operated by steam which moves its piston (see *Steam Engine*). This forces the piston in the

water end to reciprocate, and through its valves to draw in water on one side of the piston and discharge water against pressure on the other side with each of its strokes.

Rotary pumps fall into several classifications, the more important ones being (1) gear, (2) vane, (3) diaphragm, (4) axial piston, (5) radial piston, and (6) connecting-rod crank.

In the *gear-type pump*, two precision-made gears are fixed to rotate together in a case in which they are closely fitted. The fluid to be pumped is drawn in at one side of the meshing teeth, carried in the tooth spaces on the outer circumference of the gears, and discharged at the opposite side of the tooth mesh. Since the teeth wipe the inner surface of the case, fluid cannot escape back over the tips. Thus all the fluid transferred around the gears is forced out the discharge side of the mesh. The direction of the flow of fluid through the pump depends only upon the direction of rotation of the driving gear. Such units are used in automobiles for pressure lubrication and in many applications where oil is used hydraulically to power machines, tools, presses, etc. These will normally pump against pressures up to 1,000 lbs. per sq. in.

The *vane pump*, sometimes used as a compressor, is made up of a rotor having radial slots in which are fitted blades or vanes which are free to reciprocate. The rotor in turn is fitted in a case so that it rotates around an axis which is eccentric to this case. Either springs or centrifugal force hold the blades out against the case during rotation. Because of the eccentricity of the rotor, the space between the rotor vanes and the case varies from a minimum of near zero to a maximum dependent on the volume rating of the pump during each one-half revolution. By allowing the fluid to enter during this space's increase in volume and to discharge when its volume is decreasing, a positive pumping action is set up. No valves are required. The direction of flow depends only upon the rotor's direction of rotation. Such units are used extensively to pump air, gases, water, and oil, and are capable of discharging fluid against pressure heads up to 1,000 lbs. per sq. in. They are commonly used in industry to power machine tools and hydraulic presses.

The *diaphragm pump* is a rotary pump only because it is operated by a rotating cam which causes the diaphragm center to reciprocate. With two check valves so fixed that one will allow fluid to flow into the space over the diaphragm when its volume is increasing and the other so arranged as to allow fluids to escape from the space when its volume is decreasing, the pump cycle is complete. These pumps are used for circulating fluids at low pressure, particularly volatile fluids such as gasoline. Their largest application is for fuel supply to automobile engines.

The *axial-* and *radial-piston* types of rotary pumps greatly resemble each other in their operation. In both, the pistons are caused to reciprocate; during one-half a revolution of the rotor, the fluid is drawn in through valve ports to the space above the piston and during the other one-half of the revolution, it is discharged from the space through another port. Valves are unnecessary in this type. In the axial-piston type the pistons are caused to reciprocate by a cam (sometimes referred to as a "wobble plate"). In the radial-piston type the pistons are caused to reciprocate by the rotor's being eccentric with the case. Such pumps are used essentially for very-high-pressure applications, such as powering hydraulic presses, and powering hydraulic motors in such applications as operating the controls on aircraft and the steering apparatus of large ships.

The radial- and axial-piston type pumps also serve well as variable-discharge units. The variable-discharge radial pump has its rotor and rotor case in a housing; the rotor's bearings are fixed in the housing. The rotor case is so mounted in the housing that it can be varied from a maximum eccentric to a concentric position with the rotor. This varies the stroke of the piston in the rotor from a maximum to zero, thus varying the volume of fluid handled. In the axial-piston pump the variable discharge is achieved by varying the angular position of the cam (or wobble plate) with respect to the pistons. These pumps are much more expensive to construct than the previously described types but have tremendous advantage over constant-displacement units wherever accuracy of control of the powered equipment is necessary.

The *connecting-rod-crank* type of pump is used with poppet-type check valves, both as an air compressor and as an extremely-high-pressure solid-fluid pump. As air compressors, these pumps supply the power for operating many types of hand tools, rock drills, etc. As solid-fluid pumps, they are used to develop the extreme pressures that are needed on certain types of commercial presses and in certain types of laboratory equipment. Some will produce pressures, in small volume, up to 50,000 lbs. per sq. in.

Pumpkin (*pŭmp'kĭn*), a trailing plant of the gourd family native to India, but now naturalized and cultivated in practically all countries. The leaves are heart-shaped, the flowers are large with yellow petals, and the vine often grows to a length of 10 to 20 ft. Many species of pumpkin are grown, the fruit ranging in size from a few inches to 2 ft. in diameter. The seeds are situated in rows within the fruit. They are small, white, and flat. Pumpkins are cultivated in many localities of North America for domestic food and as food for cattle. The fruit is yellow or reddish. It is used chiefly in making pies.

Pun (*pŭn*), a form of wit in which an amusing effect is achieved by the use of a single word in two meanings or by the use of homonyms (*i.e.*, two words of the same sound but different meanings). Playing upon the same word, *painted*, John Donne (*q.v.*) wrote the following epigram upon a lady:

"Thy flattering picture, Phryne, is like thee,
Only in this, that you both painted be."

Playing upon the homonyms *wain* and *wane*, John Milton (*q.v.*) wrote of a wagoner that "his wain was his increase."

Puns are most often used for ludicrous effects, like those in the examples given, but they are sometimes used in very serious contexts, especially in verse, to achieve compression of thought. Examples may be drawn from the same poets. Donne, in a hymn, asks God to promise that "Thy son/ Shall shine as He shines now," thus identifying Christ and the sun, the light of the world, by employing the homonyms *son* and *sun*. Milton writes of "the fruit/ Of that forbidden tree," using the single word *fruit* not only literally to refer to the apple but also figuratively to refer to the consequences of Adam's disobedience.

Puna (*pōō'nā*), an Andean plateau, extending from Colombia to Chile, and characterized by its cold, bleak climate. Also the name of the wind prevailing there, but more specifically associated with the Puna de Atacama, a plateau of northwestern Argentina.

Punch (*pŭnch*), a tool for indenting or perforating sheets or plates of various materials, such as iron and steel, and for driving out or in an object inserted in a hole. It is usually made of steel and its shape depends upon the uses for which it is intended. Punches for cutting steel pens, buttons, jewelry, and other similar articles are hollow and sharp-edged, while those for stamping dies, perforating, and driving objects into or out of metallic plates are solid.

The name *punch* is applied to an alcoholic beverage made of wine and spirits. It is sweetened and flavored with orange or lemon, and commonly diluted with water.

The London *Punch* is a weekly magazine devoted to comic, satirical, and humorous literature. It was founded in 1841 by Mark Lemon and Henry Mayhew, and for over a century has been important in the publication of comic sketches in prose, verse, and caricature.

Punch and Judy (*pŭnch, jōō'dĭ*), or **PUNCH-INELLO**, a popular puppet show of Italian design. Its origin is ascribed to Silvio Fiorello, a comedian who flourished about the middle of the 17th century. The principal figures are Punch and Judy, two cleverly contrived puppets worked by a person within a box. A second person stands on the outside to keep up the dialogue, which is carried on with the person inside, though



SCENE FROM A PUNCH AND JUDY PUPPET SHOW

it is represented that the figures do the talking. Punch and Judy represent various scenes in domestic and public life, though generally a man and his scolding wife, the latter being carried off by a policeman or demon as the closing scene.

Punctuation (*pūn-k-tū-ā-shūn*), the art of dividing written discourse into sections by means of points for the purpose of marking the grammatical connection and dependence, and making the sense more obvious to the eye. In ancient writing words are run together successively without break or pause, though in the later specimens points are used for oratorical purposes. Aristophanes, the Greek grammarian of Alexandria, invented a system of punctuation, but this was forgotten to such an extent that Charlemagne employed several scholars to restore it. Aldus Manutius, a printer of Venice, Italy, in the latter part of the 15th century invented the main features of the modern system of punctuation. As there is no arbitrary punctuation, it is necessary to exercise good judgment and taste for the purpose of avoiding defects, ambiguity, or confusion in the construction of a sentence. A sentence unpunctuated and unspaced in the manner of the ancients is difficult to read, and at first sight appears to be written in an unknown tongue. The following is an example of the two methods, one written solid, and the other properly spaced and punctuated: Readingmakethafullmanconferencea-readymanwritinganexactman. Reading maketh a full man; conference, a ready man; writing, an exact man.

The chief use of punctuation is to divide discourse into sentences, and these again into parts, in a manner so as to show the relation of the several parts to each other. It is based largely on grammatical analysis, requiring accurate discrimination. A change in the punctuation of a sentence generally produces a change in the meaning. This is nicely illustrated by an incident con-

PUNIC WARS

nected with the proceedings of the English House of Commons, where a member was required to apologize publicly for calling another a liar. This he did, while standing in the presence of the body, in these words: "I said he was a liar, it is true; and I am sorry for it." The apology was generally accepted as satisfactory, but a London newspaper gave it a different meaning by publishing it in this manner: "I said he was a liar; it is true, and I am sorry for it." Another example of the necessity of care in punctuation is the following:

John Keys, the lawyer, says he is guilty.

John, Keys the lawyer says he is guilty.

"John Keys the lawyer," says he, "is guilty."

The principal languages employ six chief points in punctuation. These include the *period* (.), placed after every declarative or imperative sentence and after every abbreviated word; the *comma* (,), employed to denote the least degree of separation, and for separating the members of a compound sentence and dependent clauses; the *semicolon* (;), used to separate parts of sentences less closely connected than those separated by commas; the *colon* (:), sometimes employed to separate parts of sentences less closely connected than those separated by the semicolon, but more commonly used to introduce or anticipate a series to follow, or after the salutation in a business letter; the *interrogation point* (?), used to show that a question is asked; and the *exclamation point* (!) used to indicate some emotion.

Many miscellaneous marks are used for different purposes in writing. These include the *dash* (—), employed to indicate an omission, a sudden pause, a sudden or abrupt change in the construction of a sentence, and sometimes to add effect to other marks; the *parentheses* (), used to enclose words that break the unity of the sentence; the *brackets* [], employed to enclose some word or words necessary to explain or correct an error; the *quotation marks* (" "), used to enclose quotations from the language of another person; and the *apostrophe* ('), employed to indicate the omission of a letter. The *section* (§) denotes the small divisions of a book or chapter, the *ellipsis* (***) or (. . .) indicates the omission of words from a quotation, and the *caret* (^) is used to show that something has been omitted. Various marks are employed to refer to marginal notes, such as the *asterisk* (*), the *dagger* (†), the *double dagger* (‡), the *section* (§), the *paragraph* (¶), and the *parallel* (||). The *index* (☞) is used to designate some important statement or sentence.

Punic Wars (*pū-nīk wārz*), the name of three great wars between the Romans and the Carthaginians. The First Punic War was a contest for the possession of Sicily. It covered a period of 23 years, from 264 to 241 B.C., and was finally won by the Romans. Hannibal instigated the Second

Punic War to capture Saguntum and other territory. It began with the great invasion of Italy in 218 and ended by the Roman victory at Zama in 202 B.C., lasting a period of 16 years. The Romans undertook the Third Punic War with the intention of destroying Carthage and thus eliminating their rival. This war lasted three years, from 149 to 146 B.C. Although Carthage made a most heroic defense, it was utterly destroyed, never to rise again.

Punjab (*pūn-jāb'*), or PANJAB, a region divided by the partition of British India between Pakistan and India. It is drained by the five tributaries of the Indus—the Ravi, Beas, Sutlej, Chenab, and Jhelum Rivers, the word *Punjab* meaning "five rivers." Foothills of the Himalayas traverse the northern part, but in the southern portion the surface is either level or undulating and consists of a great alluvial plain. Extensive deposits of rock salt and alum beds abound in the region, and there is an abundance of limestone, which is suitable for construction. The principal products are wheat, cotton, tobacco, barley, rice, sugar cane, maize, and tea. Valuable forests are abundant, but there is a scarcity of rainfall in the plains, making extensive irrigation projects necessary. One project alone, the Sutlej scheme, waters more land than the whole cultivable area of Egypt and the Sudan. Lahore is the capital of West Punjab, Pakistan, and, since 1882, has been the seat of the Univ. of Punjab. The capital of East Punjab is Jullundur. Other important cities are Multan and Rawalpindi in West Punjab, Amritsar and Umballa in East Punjab. Although not far advanced industrially, the Punjab has a number of new manufactures produced in the cotton, silk and woolen mills, metal foundries, shoe and carpet factories, etc. Exports are chiefly agricultural products. Handloom weaving and native arts and crafts also furnish a variety of articles of trade. The region has extensive interests in rearing livestock, including camels, cattle, sheep, and goats. The Punjab has an extensive system of railways and highways, and many navigable canals. The partition of India in 1947 resulted in a major catastrophe for the Punjab which was divided between the two dominions. The Muslim western half, including Lahore and the Sikh holy shrine of Nanakana Sahib in Shekhupura district, going to Pakistan, and the Hindu eastern half, including Amritsar, the holy city of the Sikhs (*q.v.*), to India. Each sector of the Punjab exchanged its minority, and an estimated 7,000,000 to 10,000,000 people were uprooted from their homes on the two sides of the partition line. The death toll was estimated in the scores of thousands as camps, refugees, trains, and foot caravans were assaulted by hostile mobs. Another strategy of mass extermination laid to Punjab Muslim extremists was the block-

ading of large populations within flooded areas, where many were reported to have been drowned or slain in trying to escape. Pop. (mostly Mohammedans), *ca.* 28,500,000. See also *Pakistan*.

Punta Arenas (*pōōn'tā ā-rā'nās*), now MAGALLANES, a seaport of southern Chile, on the Straits of Magellan, and capital of the territory of Magallanes. Coal is worked near by, and gold is mined and shipped. Packing houses prepare frozen mutton for exportation in quantity; wool is also exported. Population, *ca.* 25,000.

Punxsutawney (*pūngk-sōō-tō'nī*), a borough of Jefferson County, Pennsylvania, 160 m. N.E. of Pittsburgh. It is on the Baltimore & Ohio and the Pennsylvania R.R.'s. Located in a coal-mining region, Punxsutawney has manufactures of precision tools, machinery, castings, refrigerator cabinets, and meat, dairy, and other products. It was first settled in 1813 and incorporated as a borough in 1849. Population, 1950, 8,969.

Pupil (*pū'pil*), in physiology, the aperture in the eye which creates the possibility of visual perception aided by the influx of light rays. The diameter of the pupil changes with the contraction or expansion of the muscles of the iris. See *Eye*.

Pupin (*pū-pēn'*), MICHAEL IDVORSKY, physicist, born in Idvor, Hungary, Oct. 4, 1858; died Mar. 12, 1935. He came to the U.S. in 1874, and after studying at Columbia Univ., New York, and Cambridge Univ., England, and also under the physicist, Helmholtz, in Berlin, he served many years as professor of electro-mechanics at Columbia Univ. (1901-31), and was also made director of Phoenix Research Laboratories (1911). He invented the Pupin coil which increased the range of long-distance telephony and discovered secondary X-ray radiation (1896). He also invented means for short-exposure X-ray photography. He wrote "From Immigrant to Inventor" (1923), for which he received the 1924 Pulitzer Prize, and "Romance of the Machine" (1930).

Purcell (*pūr'sēl*), HENRY, composer, born in Westminster, England, about 1659; died Nov. 21, 1695. Outstanding among 17th-century composers of church music, he also wrote theatrical and chamber music. He was organist of Westminster Abbey and of the Chapel Royal. His cantatas, anthems, and chants are used extensively today in the Anglican Church. He wrote the opera "Dido and Aeneas" (*ca.* 1689) and incidental music to more than 40 dramas, including "Theodosius" (1680), "The Fairy Queen" (1693), and "Timon of Athens" (1684). He also composed odes, works for the harpsichord, and choral works.

Purchasing Power (*pūr'chīs-ing pou'ēr*), in economics, the term for the relationship of money value to the price of goods. It describes also that power to buy goods which is determined by the income and the uninvested savings of the general population. See also *Consumers' Price Index*.

Purdue University (*pûr-doo' ū-nī-vûr' sī-tī*), a coeducational state institution at Lafayette, Ind., established in 1869, and so named from John Purdue, principal donor of money and land with which to start the university. It embraces schools of civil engineering and engineering mechanics, electrical engineering, chemical and metallurgical engineering, aeronautical engineering (including flight administration), mechanical engineering, agriculture (including forestry), home economics, science, pharmacy, trade and industrial education, and engineering law. Students are required to do shop and field work in addition to pursuing the usual branches of study. It has a campus of 365 acres on which are situated more than 70 buildings for instructional purposes or living quarters, exclusive of dozens of temporary structures for war veterans. The university property is valued in excess of \$25,000,000. The annual enrollment is 12,000 and the faculty numbers about 1,200.

Pure Imaginary Number (*pûr ī-mă'fī-nēr-y nūm'bēr*), a term in mathematics. See *Number*.

Pure Line (*pûr līn*), biological term for the various pure races produced after a period of self-fertilization. Once these have come into existence, each one continues to reproduce only its own genotype (*q.v.*) when it is self-fertilized.

Purgatory (*pûr'ga-tō-rī*), a concept of life after death belonging to the teachings of the Catholic Church, and signifying a place of temporary punishment after death. Venial (*q.v.*) sins are punished in purgatory. Prayers and masses offered by the relatives of the deceased are supposed to help abbreviate the sojourn of the soul in purgatory; they may even be effective enough to eliminate the stay in purgatory entirely. Protestantism does not exactly deny the concept of purgatory, but considers it of lesser importance. This may have a historical reason: Luther especially attacked the indulgences (*q.v.*), which at that time were sold with the promise that they would partly or completely eliminate the punishments of purgatory. The Anglican and the Orthodox Church uphold the doctrine of purgatory. The torments of purgatory have often been described in art and poetry, one of the most famous examples being Dante's *Purgatorio*, a part of his "*Divina Commedia*."

Purine (*pû'rīn*), a class of organic nitrogen compounds, occurring throughout the plant and animal kingdom. The commonest purine derivatives are uric acid, caffeine, and theobromine. Adenine occurs as a constituent of the nucleic acids, which are important components of living cells.

Puritanism (*pûr'ī-tan-iz'm*), a theological term signifying a movement (commencing in the 16th century) within the Church of England which tried to sharpen the differences between

this and the Roman Catholic Church and to emphasize the Church of England's Protestant character. In this tendency, the Puritans leaned most heavily on the ideas of John Calvin (*q.v.*) and his successors.

The Puritans wanted the Church of England to forego all connections with Rome in all questions of ecclesiastical authority. Emphasizing the new Protestant concept of Christianity, and anxiously avoiding all similarities with the Roman Catholic Church, the Puritans were not satisfied with the Anglican concept which saw in the worldly rulers Henry VIII and, later on, Elizabeth, the center of ecclesiastical authority. Oliver Cromwell (*q.v.*) expressed the Puritan idea not only theologically but also politically. After the Restoration in 1660, the Puritans were considered heretics from the Anglican creed as it had developed by then. Some independent Puritans had already emigrated to America and immediately split up into various Puritan sects, in the same way as the Puritans subdivided themselves in England into sects ranging from those which tolerated certain forms of the Episcopalian church to those which fought all its institutions tooth and nail (see *Congregationalism; Baptism; Separatism; Presbyterianism*).

A peculiar fact about Puritanism is that it became a religion of worldly action rather than of theological contemplation. Emphasizing all the civic virtues, especially honesty, thrift, reliability, and discipline, its ethics contributed much to the origin of modern capitalism. Furthermore, its ascetic tendency led to a definite animosity against all arts. The pious Puritan despised dancing, theater, and music; in fact, Puritans who took their religious concept seriously were actually ashamed to find pleasure in worldly things.

Pus (*pūs*), in medicine, the yellowish-green thick, fluid matter, formed in and discharged from inflamed bodies and tissues. It is composed of leucocytes, the dead white blood corpuscles, and of the bacteria which caused the inflammation.

Pusey (*pū'zī*), EDWARD BOUVÉRIE, theologian, born at Pusey, England, Aug. 22, 1800; died Sept. 14, 1882. The son of Philip Bouvérie, who assumed the name of Pusey, he graduated from Oxford in 1822. He became fellow of Oriel and was appointed professor of Hebrew at Oxford in 1828, a position he held until his death, and to which a canonry at Christ Church was attached. He visited Germany to study religious movements and in 1835 he joined Newman and Keble (*qq.v.*) in publishing "Tracts for the Times." The vice chancellor of Oxford suspended him in 1843 from the ministry for three years because he preached a sermon entitled "The Holy Eucharist a Comfort to the Penitent," which advocated the use of the confession in the Church of England. In this high-church movement, known as

Puseyism, he tried to incorporate some of the doctrines of the Roman Catholic Church into the Church of England.

Pushkin (*pōsh'kin*), ALEXANDER SERGEYEVICH, poet and writer, born in Moscow, Russia, June 6, 1799; died at St. Petersburg, Feb. 10, 1837. He was the son of a noble family and was educated at the Imperial lyceum at Tsarskoe Selo, near St. Petersburg. In 1817 he entered the Ministry of Foreign Affairs and in the same year began to write his well-known romantic epic, "Ruslan and Lyudmilla," published in 1820. In 1820 he was exiled to an official position in southern Russia because of too-liberal trends in some political poems, especially in his "Ode to Liberty." In Odessa, strongly influenced by Lord Byron (*q.v.*), Pushkin wrote the epic "The Prisoner of the Caucasus," which was followed by "The Fountain of Bakhchisarai" (1827). Meanwhile (1824), he had been dismissed from governmental service and went to live on his paternal estate. At this point he took a decisive turn toward nationalistic poetry, completing such works as "Eugen Onegin" (1832) and the tragedy "Boris Godunov" (1825, published 1831), which have become especially known through their operatic versions by Tchaikovsky and Musorgski, respectively. In 1826 he was given amnesty by Czar Nicholas I and he was then able to live first in Moscow, and after his marriage to Natalia Goncharov, in St. Petersburg (1831). In 1837 he was severely injured in a duel with a Frenchman whose attentions to his wife he resented, and died two days later. His other works include the narrative poem "Poltava," and "The Captain's Daughter," a prose work.

Pushkin has been called the most important national writer of Russia. His characterizations are full of realistic observations, but never lose their poetic approach. One of the earliest Russian novelists, Pushkin became the master whom many later Russian writers followed.

Pussy Willow (*pūs'y wil'ō*), any willow tree which bears large, silky, cylindrical catkins.

Pustules (*pūs'tūlz*), in medicine, pimples which contain pus, characteristic of certain skin diseases.

Put-in-Bay (*pōot'in-bā*), a village and summer resort on South Bass Island, in Lake Erie, forming a part of Ottawa County, Ohio. It is 40 m. E. of Toledo and has a number of fish hatcheries. On Sept. 10, 1813, Commodore Perry won a victory over the English under Capt. Barclay, the seat of battle being about 12 m. N.W. of this place. The Perry's Victory and International Peace Memorial National Monument commemorates the battle. Population, 1950, 598.

Putnam (*pūt'nam*), one of the county seats of Windham County, Connecticut, on the Quine-



ALEXANDER PUSHKIN

baug River, 25 m. S. of Worcester, Mass. It is on the New York, New Haven & Hartford R.R., and is surrounded by an agricultural region. Cargill Falls are in the center of the city. The chief buildings include the public library, the high school, and the Day Kimball Hospital. Putnam has a large trade in lumber and lumber products. Among the manufactures are worsteds, curtains, synthetic fabrics, optical goods, and steel products. Settled about 1855, it was chartered as a city in 1895. Population, 1950, 8,181.

Putnam, GEORGE PALMER, publisher, born in Brunswick, Me., Feb. 21, 1814; died in New York City, Dec. 10, 1872. He conducted a book store in London for seven years and returned to New York City in 1848, where he published *Putnam's Magazine*, which was merged into *Scribner's Monthly* in 1870, and founded the book-publishing firm which still bears his name.

Putnam, ISRAEL, patriot and soldier, born in the port of Salem, Mass., now called Danvers, Jan. 7, 1718; died May 19, 1790. He settled in Windham County, Connecticut, in 1738, where he devoted himself to farming until 1754, when he served in the French and Indian War for nine years. In the Revolutionary War he became brigadier, and for bravery at Bunker Hill was made major general by Congress. Putnam commanded at New York, Long Island, and Philadelphia, and in 1777 was appointed to defend the highlands of New York. When the British captured the forts, Putnam was relieved of his command, although a court of inquiry later acquitted him of any fault. In 1779 he made a visit to his home, where he was stricken by paralysis and was obliged to give up active military life. Putnam was one of the chief "Sons of Liberty," and was a leading figure in the stirring times that characterized the early part of the Revolution.

See picture on the following page.



ISRAEL PUTNAM

Putnam, NINA WILCOX, novelist, born at New Haven, Conn., Nov. 28, 1888. She began to write short stories at the age of 11. Her books include "It Pays to Smile" (1920), "Say It With Bricks" (1923), "The Bear Who Went to War" (1928), "The Making of an American Humorist" (1929), "Laughing Through" (1930), "Paris Love" (1931), and "The Inner Voice" (1940).

Putnam, RUFUS, soldier, born in Sutton, Mass., Apr. 9, 1738; died in Marietta, Ohio, May 1, 1824. A cousin of Israel Putnam (*q.v.*), he studied mathematics and surveying, and in 1773 became a deputy surveyor in Florida. At the beginning of the Revolutionary War he became chief engineer with the rank of colonel but resigned soon after to take command of the 5th Mass. Regiment. In 1778 he aided Israel Putnam in fortifying West Point. He was made brigadier general in 1783, served in the Massachusetts legislature, and in 1787 aided Governor Lincoln in suppressing Shays' Rebellion. In 1788 he assisted in founding Marietta, Ohio. He was judge of the supreme court of the Northwest Territory (1790-96) and U.S. surveyor general (1796-1803).

Putrefaction (*pū-trē-fāk'shūn*), the decomposition of animal or vegetable substances, generally accompanied by fetid odors. It is now regarded as a kind of fermentation caused by the growth of minute plants called *bacteria* (see *Bacteriology*) which enter the putrescible bodies—that is, those decomposing at a certain temperature in contact with air and moisture—in which they grow and multiply. Great numbers of spores of bacteria and kindred organisms are present in the air and water, but they develop most rapidly by the free contact of humid air at a temperature ranging from 60° to 80°. Putrefying animal matters give off more unpleasant gases than vegetable matters because nitrogen is more abundant in the former. Organic bodies of a higher order

are changed in the process of putrefaction into lower organic compounds, but also into such inorganic compounds as ammonia and sulphuretted hydrogen, and into such substances as nitrogen and hydrogen. Putrefaction may be arrested or prevented under various conditions, such as keeping the substance perfectly dry, by the use of antiseptics, by keeping the substance in a temperature near the freezing point, by keeping it in a vacuum, or in a vessel containing air deprived of all organic germs, and by heating to the boiling point and then sealing to keep out all atmospheric air.

Puyallup (*pū-āl'úp*), a city of Pierce County, Washington, 10 m. s.e. of Tacoma, on the Northern Pacific, the Union Pacific, the Chicago, Milwaukee, St. Paul & Pacific, and the Great Northern R.R.'s. It is in a fertile valley which produces chiefly hops, fruit, and bulbs. Food processing and the manufacturing of paper, insecticides, and wood products are the chief industries. It was laid out in 1877 by Ezra Meeker and incorporated in 1890. Population, 1940, 7,889; 1950, 10,010.

Pye (*pī*), HENRY JAMES, poet, born in Berkshire, England, Feb. 20, 1745; died Aug. 11, 1813. He studied at Oxford, and became a member of Parliament in 1784. After six years he retired and in 1792 became justice of peace at Westminster. Through the favor of William Pitt he became poet laureate in 1790, but his appointment was ridiculed by literary men. His epic in six books on King Alfred (1801) and his other poetry are considered mediocre.

Pygmalion (*pīg-mā'li-ūn*), in Greek legends, the King of Cyprus and grandson of Agenor. After making an ivory statue of a young maiden, he fell in love with it, and at his entreaty Venus endowed it with life. Later the maiden became his wife and is noted as the mother of Paphos. George Bernard Shaw made use of a somewhat similar theme in his play "Pygmalion" (1912) which was made into a motion picture in 1938.

Pygmy (*pīg'mī*), or **PIGMY**, (1) one of a group of the colored (black) race characterized by shortness and slightness of stature, usually not larger than a seven- or eight-year-old white child. They are a very primitive group found deep in the jungles of Central Africa. (2) A very small person or a dwarf. See also *Dwarf*; *Midget*.

Pyle (*pīl*), ERNEST TAYLOR ("ERNE"), columnist, born near Dana, Ind., Aug. 3, 1900; died Apr. 18, 1945. He entered Indiana Univ. to study journalism, but left a few months before graduating to work as a cub reporter on the La Porte, Ind., *Herald* (1923), and a few months later went to work for the Washington *News* as copy editor. Going to New York in 1926, he was on the staff of the *Evening World* and the *Evening Post*, and from 1928 to 1932 covered aviation for the Scripps-Howard papers. He returned to Washington in 1932 as managing editor of the Wash-

ington *News*, but left again three years later to travel as a roving correspondent in the Western Hemisphere, and his simple, human descriptions of what he saw were soon widely read. His war reporting began when he went to London in 1940, and his collected columns on the Battle of Britain were published a year later under the title "Ernie Pyle in England." He landed with American troops in North Africa and went on to cover the war fronts in Sicily, Italy, England, and France. Two more books came from his columns, "Here Is Your War: the Story of G.I. Joe" (1943), and "Brave Men" (1944), before he returned to the U.S. to rest, late in 1944. However, he was soon on his way to the Pacific Theater of war where he was killed by a Japanese sniper on Ie Jima. More, probably, than anyone else, Pyle helped bring back home the story of the heroism and suffering of the fighting men, and he was loved by the millions who read his daily columns for the self-sacrifice of his work with the front-line troops.

Pyle, HOWARD, author and artist, born in Wilmington, Del., Mar. 5, 1853; died Nov. 9, 1911. He studied art in a private school at Philadelphia and at the Art Students' League in New York City. He taught at the Drexel Inst., Philadelphia (1894-1900), and founded an art school at Wilmington. He was outstanding as an illustrator of juvenile and adventure books. Many of his subjects are from the early colonial period of America and adventures upon the sea. His books include "The Rose of Paradise," "A Modern Aladdin," "Merry Adventures of Robin Hood," and "The Story of King Arthur and His Knights."

Pym (*pim*), JOHN, statesman, born at Brymore, England, in 1584; died Dec. 8, 1643. He was descended from a good family and entered Oxford Univ. in 1599, which he left before graduating to study law at the Middle Temple. In 1614 and again in 1621 he was elected to Parliament and there became distinguished as a defender of Parliamentary rights and civil liberties and an opponent of the monopolies and absolutism favored by the court of James I. He opposed the Duke of Buckingham, a favorite of Charles I, in the famous impeachment trial in 1626, and in 1640 became a leader of the Short Parliament, after that body had been in abeyance for 13 years. At the beginning of the session Pym delivered an elaborate address, in which he summarized the grievances of the nation. When Charles I dissolved the Short Parliament, Pym forced him to summon it again that same year. In this session, known as the Long Parliament, Pym boldly denounced the Earl of Strafford as an oppressor and tyrant and succeeded in having a bill of attainder passed upon him. He also was instrumental in passing a bill which made it impossible for the king to dissolve the Parliament

without its consent. He thwarted the king's attempts to oust Parliament with the aid of the army. Open hostilities soon followed between the royal and the parliamentary forces. During the Civil War, in 1643, Pym was appointed lieutenant of ordnance but died about a month later.

Pyorrhoea (*pī-ō-rē'ā*), a disease of the gums and mouth, of bacterial origin, causing inflammation, receding gums, abscesses near the teeth, and sometimes bodily infection. A competent dentist should be consulted at an early stage. The teeth should be kept clean and peroxide and similar preparations used as a mouthwash.

Pyramid (*pir'ā-mīd*), an architectural structure of solid masonry, built for various purposes in different parts of the world. The most remarkable pyramids are those of Egypt, situated in a group at Gizeh, near Cairo. This group begins at a point nearly opposite Cairo, on the border of the Libyan Desert, and extends southward about 25 m. They consist of colossal masonry, rising from a rectangular base, and terminating in a point so as to form four triangular sides. The principal material used in their construction is a durable limestone quarried from the hills near by, though great slabs and blocks of granite were placed on the outside to increase durability; these were evidently taken from quarries at great distances from the location of the pyramids. It is supposed that these structures date from a period between 3000 B.C. and 2300 B.C., and that they were designed mainly as sepulchral chambers of the kings. The most remarkable group consists of nine pyramids about 4 m. S.W. of Cairo, where stood the ancient city of Memphis.

The Great Pyramid belongs to this group and was reared above the tomb of Cheops, the second king of the fourth dynasty. It was originally 481 ft. high and 756 ft. square at the base, and is counted as one of the Seven Wonders of the world. Some of the stones are of remarkable size, and it has long been a subject for speculation as to how the ancients were able to provide mechanical power sufficient to quarry, transport, and elevate them to their proper places. Herodotus, the Greek historian, estimated that it required 100,000 men for a period of 10 years to construct a causeway for the transportation of the stone from the quarries for this single pyramid, and that the labor of the same number of men was required for 20 years to complete the structure. The apex of this pyramid was once quite sharp, but now a flat about three yards square exists at the upper part. It has suffered from removal of a part of the material to construct mosques and temples at Cairo, but still covers 13 acres and is 451 ft. high. A series of steps averaging about 3 ft. in height are at the outer surface, though these were originally hid-



PYRAMIDS AT GIZEH, EGYPT

The tombs of the Egyptian king Chephren and Mykerinos, these pyramids date back to about 2800 B.C.

den by a coating. In the interior are several chambers ornamented with red granite. They may be entered only through an opening on the north side, about 50 ft. above the base. Some writers think that this pyramid was built as an astronomical observatory, since the ratio of its height to the perimeter of its base is as nearly as possible that of the diameter of the circle to its circumference, and there are other structural peculiarities in support of this view.

The Gizeh pyramid of second importance is one built by Chephren, third king of the fourth dynasty. It covers about 10 acres, has a base 700 ft. square, and is 448 ft. high. In this pyramid are two sepulchral chambers that were opened in 1816. Though they were once encased and ornamented with polished stones, only a portion of the casing remains. The third pyramid of this group was built by Menkaure, fourth king of the fourth dynasty, and is 354 ft. square at the base and 212 ft. high. It is the best constructed of the three greater pyramids, and still displays the best evidences of former beauty. The other six pyramids of the Gizeh group are smaller and of less interest. Another noted pyramid is about 5 m. N.W. of Gizeh, at the village of Abu Roash. Several groups are in Nubia, probably built by the kings of ancient Ethiopia. Pyramids of considerable importance are situated in various parts of Assyria, China, India, Greece, and Italy.

The pyramids of Mexico, dating from the time of the Aztecs, are four-sided structures. The most important group still existing is at Teotihuacan, 20 m. N.E. of the city of Mexico. It includes several hundred structures, but only two of importance. The largest has a base 900 ft. square, with a height of 160 ft., while the second is 130 ft. high. The most noted of Mexico is that of Cholula, having a length of 1,585 ft. and a height of 178 ft. The Mexican pyramids are inferior to those of Egypt and are less remarkable and durable in structure, but all are uniform in facing the cardinal points. See also color plate, *Architecture I*, Volume XII.

Pyramid Lake (*pī'ā-mīd lāk*), the largest

PYRITES

lake in Nevada, situated 20 m. N.E. of Reno. So named from the pyramid-shaped islands of gray stone which rise from its surface, it is 30 m. long, with a surface of 390 sq. m.

Pyramus and Thisbe (*pī'ā-mūs, thīz'bē*), the two lovers mentioned in the fourth book of Ovid's "Metamorphoses," whose tragical history is introduced as an interlude in Shakespeare's "A Midsummer Night's Dream." These two lovers were tenderly devoted to each other, but could not obtain parental consent for their marriage, and so they met secretly and conversed through an opening of the wall in their adjoining houses. It was agreed at one time that they should meet at the tomb of Ninus. Thisbe was the first to reach the place of meeting, but a lioness caused her to flee for safety. She dropped her robe in the flight, which the lioness at once seized and covered with blood from an ox it had torn to pieces the same day. When Pyramus appeared he discovered the blood-stained robe and concluded that Thisbe had been killed, and, despairing, immediately ended his life. Shortly after, Thisbe returned to the trysting place, and, when she discovered the dead body of her lover lying upon the ground, she likewise killed herself.

Pyrenees (*pī'ē-nēz*), the lofty mountain range which separates France from Spain, extending from the Atlantic to the Mediterranean. The mountain range consists of two parallel chains, about 20 m. apart. Its length from the Bay of Biscay to the Gulf of Lyons is 275 m., and its width is from 25 to 75 m. Toward the center, nearly midway between the Atlantic and the Mediterranean, are the highest peaks, Mt. Maladetta, 11,424 ft., being the culminating point. Only a few good passes occur in the Pyrenees, but in 1885 two railway lines were authorized by France and Spain to penetrate the mountains, partly at the expense of each government. These railways are located near the extreme ends of the chains. The Pyrenees slope most abruptly toward the south, but there are fine springs and health resorts in both countries. The Basques (*q.v.*) inhabit the region.

Pyridine (*pī'rī-dēn*), C_5H_5N , a basic nitrogenous compound occurring from the destructive distillation of proteins, and also found in wood and coal tar. It is a disagreeable-smelling liquid, miscible with water, and forms salts with acids which are usually water-soluble. Its specific gravity is 0.99, and its boiling point is $115^\circ C$. Chemically, it has a ring structure and has affiliations with many alkaloids, such as nicotine and piperidine. It is used as a denaturant for alcohol and as a solvent.

Pyrites (*pī-rī-tēz*), the name of any one of the native metallic sulphides that occur in rocks of all ages. Formerly the name was applied only to sulphuret of iron, but now the term has a

general application, and the various groups are designated as iron pyrites, copper pyrites, cobalt pyrites, etc. The pyrites consist of metals compounded with sulphur or arsenic, or with both. The color is yellowish and the consistency is crystalline and hard. Sulphuric acid is derived from iron pyrites; cobalt, from cobalt pyrites; and copper, from copper pyrites. Nickel pyrites has a copper-red color and yields nickel and arsenic.

Pyrogel (*pī'rō-jēl*). See *Chemical Warfare*.

Pyrometallurgy (*pī-rō-mē't'al-ūr-jī*), the extraction of metal from its ores by the use of fire or heat, as contrasted to electrometallurgy which is the extraction of metal by electrolysis. Pyrometallurgy has been used from earliest times, when man first extracted iron from iron ores by roasting them. During the process of roasting ores, hydrated oxides lose their water; carbonates are decomposed and frequently oxidized, and some of the sulphides are converted into oxides. Following the roasting process, heat is also used in the reduction process. Roasted ores may be reduced either with carbon or aluminum. Most oxides, such as those of copper or iron, during reduction with carbon form carbon dioxide or carbon monoxide gases, leaving the metal. Some oxides, such as those of chromium, which are not reduced by carbon, can be reduced with aluminum.

Pyrometer (*pī-rōm'ē-tēr*), an instrument for the measurement of high temperatures, ranging greatly above the ordinary thermometers. The first instruments of this kind were based upon the principle that metals expand when subjected to heat, but they proved of comparatively little value for the reason the expansion does not increase proportionally with the rise of temperature. Later graphite was substituted for the platinum rod that was used, and with it a very high temperature may be measured with reasonable accuracy. At present the most modern forms of the pyrometer are: the optical pyrometer, which measures temperature by the color of light emitted by burning metal; the electrical resistance pyrometer, which by means of a Wheatstone bridge calibrates the resistances in platinum wire (these electrical resistances being known quantities at certain temperatures); the mechanical pyrometer, in which a pointer is moved by the differential expansion of two dissimilar metals; and the recording thermometer, which utilizes the expansion of mercury, ether, or other liquid vapors to actuate a pressure-recording device. These are used in metallurgy, thermodynamic studies, and in such industries as the manufacture of steel where excessively high temperatures are a processing factor.

Pyrophosphoric Acid (*pī-rō-fōs-fōr'ik*). See *Phosphoric Acid*.

Pyrotechny (*pī'rō-tēk-nī*), the art of making

and using fireworks. It is of great antiquity and was practiced among the Chinese with much skill before the art became known in other countries. While the Romans used candles, small rockets, and other similar articles, the Chinese developed a system of most brilliant mechanical arrangements, such as movable figures and devices, including those from which the figures of men and animals dart to surprise the company. See also *Chemical Warfare*; *Fireworks*.

Pyroxene (*pī'rōks-ēn*), or AUGITE, a mineral of numerous varieties, composed of calcium, magnesium, and a small quantity of iron or zinc. Other minerals that enter the composition include lime, manganese, soda, and silicic acid. Minerals of this class are found in limestone and other rocks in which they are crystallized. Many igneous or eruptive rocks contain pyroxene.

Pyrrhus (*pī'r'ūs*), King of Epirus, born about 318 B.C.; slain at Argos in 272 B.C. He was a distant relative of Alexander the Great and was placed on the throne when only 12, but after five years the crown was transferred to Neoptolemus, his great-uncle. Pyrrhus soon joined the army and distinguished himself in the battle against Antigonus, at Ipsus, in 301 B.C., and thereby recovered his dominion and shared it with his rival. In 295 B.C. he deposed his rival and became sole King of Epirus. After adding parts of Macedonia to his dominion the following year, he joined the Greeks in an invasion of Italy against the Romans, and in 280 B.C. won the celebrated battle on the Siris River, in which he terrorized his opponents by leading a charge with a large number of elephants. This victory cost him many of his best men, and after a second battle he concluded a truce and retired to Tarentum, where he wintered. In 279 B.C. he attacked the Romans in Apulia, and was successful in defeating them at Asculum, although at an extremely heavy cost. It was after the battle of Asculum that he is said to have commented, "One more such victory and I am lost." Thus, the expression "Pyrrhic victory" signifies any gain made at heavy cost. The next year he invaded Sicily to expel the Carthaginians, but after several brilliant successes he was repulsed by the latter with great loss. In 275 B.C. he made another invasion of Italy, but was defeated near Beneventum by an army under Manius Curius Dentatus, and escaped to Tarentum with only a few of his men. His next enterprise was to invade Macedonia, where he secured a success so complete that the Macedonian troops joined him in a body. Shortly after, he invaded the Peloponnesus against the Spartans. His attempt to take Sparta was unsuccessful and he next proceeded against Argos, where he was killed.

Pythagoras (*pī-thāg'ō-rās*), Greek philosopher, founder of the Italic School of Philosophy,

born on the Island of Samos about 582 B.C.; died at Metapontum about 500 B.C. The philosophical doctrines of Pythagoras and his school were not so much an explanation of the mysteries of the universe as a set of principles governing individual conduct. The disciples admitted to the school (founded at Crotona in southern Italy in 530 B.C.) were admonished to strict obedience and silence, abstinence from such worldly vanities as rich food and elaborate dress, and the practice of frequent self-examination.

Pythagoras believed in the immortality of the soul, and a story is told of how he professed to recognize the voice of a dead friend in the howling of a dog. His philosophical influence was extinct by the middle of the 4th century, but significant mathematical and astronomical discoveries which he made survive to this day. He and his followers were responsible for such important mathematical contributions as the fundamental theorem of the square of the hypotenuse in a right-angled triangle being equal to the squares of the other two sides. He was one of the first thinkers to hold that the earth and the universe are spheres, and that the sun, moon, and planets move by definite laws, independent of the motion of the earth. These theories were considerably in advance of the thought of his time.

Pythia (*pīth'ī-ā*). See *Pythoness*.

Pythian Games (*pīth'ī-an gāmz*), one of the four great national festivals of Greece, celebrated every fifth year in honor of Apollo, at Delphi. It is said that they were instituted by Apollo after he had overcome the dragon Python, and until 586 B.C. they took place every eighth year, but at that time they came under the direction of the Amphictyons, who instituted their celebration every four years. They consisted of athletic sports, flute playing, and chariot and horse racing. Later contests in sculpture, painting, tragedy, and historical recitations were added. Prizes of gold and silver were awarded in the early history of the games, but afterward the laurel wreath and the palm branch were substituted. These games were in importance next to the Olympic games and continued to be played until about 394 A.D. The four-year period between the celebrations of games was known as a *Pythiad*.

Pythias (*pīth'ī-as*). See *Damon*.

Python (*pī'thōn*), a genus of snakes native to the tropical regions of Africa and Asia, closely allied to the boa. They differ from the boa mainly in having double plates under the tail, teeth in the intermaxillary bone, and pits in the shields around the margins of the upper and lower jaws. Pythons attain a length of from 15 to 30 ft., and crush their prey in their coils. The tail is prehensile; with it they suspend themselves from the branches of trees near places

where animals come to drink, and take them unawares by casting their coils about the neck and body. They are capable of strangling deer, tigers, buffaloes, and other animals. The two most important species are the *rock snake* of the East Indies and the *Natal rock snake* of Africa. Allied but smaller species are found in Australia and the Malay peninsula. The female python lays its eggs in a nest near a body of water and hatches them by the heat of the body. See also color plate, *Venomous and Constrictor Snakes*, Volume IX.

Python, in mythology, a great serpent that came from the slime of Deucalion's Flood. It lived in the cave of Mt. Parnassus, which no one approached without being killed. Apollo finally killed it with his golden darts. It is supposed that the python represented the unhealthful pools and marshes, while Apollo, the sun, dried up these swamps with his rays.

Pythoness (*pī'thō-nēs*), a priestess of Apollo, generally pictured as seated on a tripod and delivering Delphic oracles.

Pyx (*pīks*), a small vessel of the size and shape of a railroad watch case, made of gold or gold plated, used in the Latin rite of the Roman Catholic Church for carrying the Host to the homes of the sick. In medieval times, the pyx was the small vessel containing the Host, sometimes of ivory but more often of pure gold. This pyx was placed in the Dove (*q.v.*) which hung suspended from the ceiling of the church. The round vessel for holding the large Host for benediction is even today sometimes called a pyx. It is used for reserving the Host in the tabernacle.

The name pyx is also applied to a strongbox used in the mint to deposit specimens of the coinage. The coins kept in the pyx are examined by a commission of experts for the purpose of testing their accuracy as to weight and fineness. In Great Britain at least one examination is made every year by a jury of goldsmiths, and this examination is called the *trial of the pyx*. A similar examination is made in February at the mint in Philadelphia. It takes place before the judge of the district court of the U.S. for the eastern district of Pennsylvania, the assayer of the New York assay office, the comptroller of the currency, and other persons appointed by the President.

Pyxie (*pīks'ī*), a small shrub native to North America, found in the region from Maine to North Carolina. It is a creeping or trailing plant and thrives best in a moist and sandy soil. The flowers are pink and white and appear early in spring. The plants grow wild, but they yield choicer flowers under cultivation.



Q (*kû*), the 13th consonant and 17th letter of the English alphabet. It has only one sound, that of *k* or hard *c*, and is always followed by *u*. It is used mostly as an initial letter of a word and never as the final letter. Since its office could be filled by *kw* or *k*, it is superfluous in English. The Anglo-Saxons did not use it, its sound being expressed by *cw* or *cu*, but later adopted it from the Latin-French. It is so named from the French word *queue*, meaning "tail," its form being an O with a tail attached.

Q-Boat (*kû'bôt*), name applied in World War I to British naval vessels camouflaged as merchant ships to deceive enemy submarines.

Quadragesima (*kʷöd-râ-jēs'i-mâ*), from Latin *quadragesima* meaning 40, term for the Lenten season which comprises 40 days.

Quadrangle (*kʷöd-rân-g'l*), any geometrical rectilinear figure consisting of four sides and, consequently, four angles. Special quadrangles are the square, the rectangle, the trapezoid, the parallelogram, the rhombus, etc. That part of the country covered by one sheet of the U.S. Geological Survey's Atlas is also referred to as a quadrangle.

Quadrant (*kʷöd-rant*), an instrument for measuring altitudes, so named because of its being graduated on a scale of 90°, the quarter of a circle.

Quadratic Equation (*kʷöd-rät'ik ê-kwä-zhün*), an equation containing no higher power of the unknown variable than the second. Every quadratic equation in one unknown variable, *x*, may be expressed in the form:

$$Ax^2 + Bx + C = 0$$

where *A*, *B*, and *C* are constants and *A* is not zero. The earliest example of the quadratic equation was found in an Egyptian papyrus of the

same period as the Ahmes papyrus, 3000 B.C. In the first half of the 9th century the Arabs recognized that all quadratic equations have two roots, which may be irrational.

Quadrature (*kʷöd-râ-tûr*), the process of finding the side of a square or rectangle having the same area as a given curve by the use of straightedge and compass. The quadrature of the circle is a problem originating with the Greek mathematician Anaxagoras (500-428 B.C.), of the Ionic school, who spent his time in prison trying to solve it. Many mathematicians worked on this problem before F. Lindemann proved it impossible of solution by proving π an irrational number in 1882.

Quadriga (*kʷöd-rî'gâ*), the name of a Roman car or chariot drawn by four horses abreast. It came into use during the Olympian games of Greece, but was later adopted by the Romans for races and performances in the circus.

Quadrilateral (*kʷöd-rî-lât'ēr-al*), in military science, a combination of four fortresses, so situated that each may effectually support the others in case of an attack. Fortresses located in this manner make it necessary that an enemy employ a large army to attack successfully the combined position.

Quadrille (*kʷä-drîl'*), in French, *square*, the name of a dance of French origin, so called because the dancers are arranged into squares, each consisting of four couples. It originated in the 18th century and formerly was in extensive use in Europe and America. The movements are consecutive, generally five in number, and are directed by a caller and accompanied by music.

Quadrillion (*kʷöd-rîl'yün*), a thousand trillions or 1000 raised to the fifth power in the French and U.S. system of notation. It is written

1 followed by 15 ciphers. The English and German quadrillion, written 1 with 24 ciphers attached, is 1,000,000 trillions. In the U.S. system of numeration each denomination is 1,000 times the preceding one, while in the English system each denomination is 1,000,000 times the preceding one. The two systems are alike up to 1,000,000.

Quadrumanā (*kwōd-rōō'mā-nā*), the name of a division of mammals which include the apes, monkeys, and lemurs, so called from their having a grasping hand on each of the four extremities. In this respect they are distinguished from the *Bimana*, or the human races, in which only the fore limbs have hands. However, they are usually classed with the true quadrupeds. They are almost exclusively confined to the tropical regions and feed principally on vegetable food in a state of nature. While the chimpanzee and gorilla approach the human types of organization, the lemurs and others seem to form an intermediate place between the bats and the carnivora.

Quadruple Alliance (*kwōd'rōō-p'l a-tī'āns*), the name applied to several alliances formed by various European states for the purpose of counteracting political tendencies or promoting compliance with recognized treaties. In 1718 England, France, Austria, and the Netherlands formed an alliance against Philip V, of Spain, when he attempted by force to nullify the settlements dictated by the Peace of Utrecht after the War of the Spanish Succession (*q.v.*). Philip, guided by his minister Alberoni, finally abandoned his political designs after prolonged conflict. The quadruple alliance of 1815 was formed by Great Britain, Austria, Russia, and Prussia against the return of Napoleon I to France. In 1834 Great Britain, France, Spain, and Portugal formed an alliance to strengthen the constitutional government of Spain against the Carlists. These were the supporters of Don Carlos, the uncle of Queen Isabella II; claiming the throne, he refused to recognize his niece after she succeeded (1833) her father Ferdinand VII.

Quaestor (*kwēs'tōr*), the title of certain magistrates of ancient Rome, whose offices were established in the early period of the Roman kingdom. The duties pertaining to the office included management of the public treasury, the receipt of tribute and taxes, and the payment of moneys on account of public service. Patricians were at first the only persons eligible to the office, but in 421 B.C. the number was increased from two to four, and the plebeians became eligible to service. With the annexation of acquired territory the duties of the quaestors were multiplied, and the number was increased accordingly. At the beginning of the First Punic War eight quaestors were provided for, and these

were increased to 20 by Sulla and to 40 by Julius Caesar.

Quagga (*kwāg'gā*), an animal of the horse genus, native to South Africa, but now extinct or assimilated with the zebra. This class of animals differed from the zebra in being stronger and heavier and in having no stripes on the limbs, though the head and neck closely resembled those of the zebra. The color was a dark reddish-brown on the upper parts, with white bands on the head and neck, and a black line running along the spine. They had no warts on the hind legs, the mane was short and upright, and at the shoulders they were about 4 ft. high. The lower parts of the body were white, but there were bars of a brown or black tinge at the upper parts of the legs. They were so named from the voice, which somewhat resembled the bark of a dog. They did not generally associate with the zebra, but, since they were gregarious in habit, the remaining numbers joined the herds of zebras. Formerly many quaggas roamed on the plains of South Africa. They became extinct because their skins were valuable in the manufacture of boots and shoes, for which they were hunted by the Boers and other European settlers.

Quai d'Orsay (*kā d'ōr-sā'*), a term popularly applied to French foreign policy, derived from a street on the left bank of the River Seine in Paris, France, in which is located the Ministère des Affaires Étrangères (Ministry for Foreign Affairs).

Quail (*kwāl*), a class of birds of the partridge family, differing from other partridges mainly in being smaller and having longer wings and a shorter tail. They are capable of enduring flight more successfully than the grouse. The average length of the body is about 7 in., but they differ greatly in size, ranging from the large species of Europe to the small quails, about 4 in. long, found in China. Twelve American species have been described, the best known being the common quail, which is sometimes called *bobwhite*, because of its call note. It is mainly reddish-brown in color, with mottled markings of a darker hue, and is about 10 in. long. Its claws are acute and slightly curved. Another American species, the *California quail*, is found mostly in Mexico and the southwestern part of the U.S. It is known for its crest of a few feathers. The common quail of Europe is migratory, but those of North America do not migrate. Quail feed on grain, seeds, and insects. The young brood is guarded carefully by the mother, though in habit quails are somewhat quarrelsome among themselves. The female builds a nest in the ground, where from 8 to 15 eggs are laid. They never perch in trees, but rest on the ground at night and seek shelter in the winter by gathering in

QUAKERS

groups under shrubs, grasses, and vines. The flesh is considered a great delicacy on account of its fine flavor and tender qualities.

Quakers (*kwāk'ērz*), or SOCIETY OF FRIENDS, a Protestant sect which arose in England about 1648 under the influence of George Fox and others who were searching for an inner spiritual religion. Fox was a man of zealous devotion and pure life, and after preaching for some years in churches and public places he gathered about him a number of other laymen and women who called themselves "Publishers of Truth," and who assisted him in spreading the doctrines. Many persecutions were perpetrated upon him and his followers and some were even condemned to penal colonies by the authorities, but through persevering efforts their teachings won a strong foothold in Great Britain and America. At first no particular organization and discipline were adopted. Later, however, monthly, quarterly, and yearly disciplinary meetings took place. Such learned men as William Penn and Robert Barclay were prominent and Penn played an important role in the colonization of New Jersey and Pennsylvania. The Quakers have not been numerous either in Europe or America but their purity of life and firm and uncompromising position on various questions have given them a prominent position in public affairs.

The Society of Friends is one of many sects that arose after the Reformation. Among their tenets is the view that the Spirit of God is revealed immediately to each soul. They base this belief on personal experience and support it by reference to passages in the first chapter of the Gospel of St. John, where the Word is spoken of as the life and light of man, and as "the true Light, which lighteth every man that cometh into the world." It is held that this light comes both to the heathen and the Christian and manifests the love and grace of God toward all mankind. They deny the necessity of the practice of the sacraments of baptism and the Lord's Supper, and hold that the form of worship in which a person waits in silence and patience upon God is best. They practice simplicity in dress, speech, household furniture, marriage, and funerals. Much stress is laid upon earnestness and honesty, and members are duty bound to pay their debts in full, even after having been released from legal payment by bankruptcy or the statutes of limitation. In the main the Friends agree with other sects of Christianity, although they do not adopt credal statements of belief. They look upon atonement as an inner experience in which they are brought into unity with God through Christ. They believe that by the power of this unity, evil can be overcome by good. The Quakers have been active in supporting temperance and in oppos-



QUAKER MEETING, ABOUT 1710

ing slavery, war, and capital punishment.

At present there are Quakers in many countries of the world. Since the World Conference held in 1937 at Swarthmore and Haverford, Pa., all Friends in the world have been brought into closer contact with one another through the Friends' World Committee for Consultation. The Quakers maintained no formal ministry until the beginning of the 20th century. Today about three-fourths of the members in the U.S. have a paid ministry, commonly known as pastors.

In England and elsewhere there is no separation of Quakers into branches. In America there are three principal divisions. In recent years there has been a tendency for the three groups to work together in America. Some Meetings have united and a number of new United Meetings have been formed. The largest group in America is called Orthodox, or "Gurneyite." Most of its members are organized in the Five Years Meeting, which convenes every five years. Its headquarters are at Richmond, Ind. This group is distributed widely over the U.S. and Canada and has over 800 congregations and over 75,000 members. It is numerically strongest in Indiana, Ohio, North Carolina, Iowa, and Kansas. Another group called Liberal, or "Hicksite," comprises the Friends General Con-

ference which meets biennially and has headquarters in Philadelphia. They have about 200 Meetings and about 18,000 members. The third group, called Conservative, or "Wilburite," follows the simplicity of early times. In the place of organization, their fellowship is bound together by visiting ministry and by Yearly Meetings.

The Quakers have devoted much attention to education. Their colleges in the U.S. are: Haverford Coll., Haverford, Pa.; Swarthmore Coll., Swarthmore, Pa.; Guilford Coll., Guilford College, N.C.; Wilmington Coll., Wilmington, O.; Earlham Coll., Richmond, Ind.; William Penn Coll., Oskaloosa, Iowa; Nebraska Central Coll., Central City, Neb.; Friends Univ., Wichita, Kan.; Whittier Coll., Whittier, Cal.; and Pacific Coll., Newburg, Ore. They also have a number of elementary and secondary schools. Their periodicals include: *The Friend*, London; *The American Friend*, Richmond, Ind.; and *Friends Intelligencer* and *The Friend*, Philadelphia.

The foreign relief work of the Friends is conducted by the American Friends Service Committee, Canadian Friends Service Committee, and Friends Service Council, London. During and between the two world wars, the Friends extended much aid to all those oppressed by war and the Nazi regime. Friends joined with other churches in the U.S. in supporting conscientious objectors to war. They continued their extensive foreign relief work after World War II. The Nobel Peace Prize for 1947 was shared by the American Friends Service Committee and the British Society of Friends Service Council in recognition of their humanitarian work.

Quamash (*kwōm'āsh*), or BISCUIT ROOT, a plant of the lily family, closely allied to the hyacinth. It bears purple flowers, has an erect stem, and yields a bulb of considerable size. These bulbs are a nutritious food with an agreeable taste and are eaten after being roasted by the Indians. Several species of quamash are found in the western part of North America, especially on the prairies.

Quantum Theory (*kwōn'tūm thē'ō-rē*), a theory in which energy of a system is expressed as a multiple of a fundamental energy unit called a *quantum*. The theory was proposed in 1900 by Max Planck (*q.v.*). While Planck's original application of the theory was to thermal radiation, it has been applied with success to many atomic systems. In this theory, the problem of the thermal black-body spectrum was reduced to one of the average energy of an oscillator at a given temperature. According to Planck the energy of an oscillator cannot vary continuously but must take on one of the discrete set of values: $0, h\nu, 2h\nu, \dots$ where h is a constant of propor-

tionality and ν the frequency of the radiation oscillation. The assumption of a discrete set of possible energy values, or energy levels, for an oscillator was completely contradictory to classical physics. According to this new conception emission of radiation could occur only when the oscillator "jumps" from one energy level to another; if it jumps down to the next lower one, the energy $h\nu$ that it loses is emitted in the form of a short pulse of radiation. It was assumed that an oscillator can absorb a quantum $h\nu$ of radiant energy and jump instantaneously up to its next higher energy level. This last assumption was later modified in such a way that the theory allowed continuous absorption. It is the universal constant h that represents the essentially new element introduced into physics by the quantum theory. We know today a great deal more about the numerical value of h , which is 6.61×10^{-27} erg per second, than we know of its physical significance. See also *Atomic Energy*.

Quapaw (*quā'pā*), a tribe of North American Indians, belonging to the Sioux family. They speak a dialect of the language spoken by the Kaw, Omaha, and Osage tribes. Formerly they occupied a large region along the lower Mississippi, from the mouth of the Ohio to the Gulf of Mexico. In the early days of the Louisiana Colony they were allies of the French. At present they number a few hundred and are on reservations in Oklahoma.

Quarantine (*qwōr'an-tēn*), from Italian, *quaranta*, 40, a term used in public health phraseology, defining: (1) The time, formerly 40 days, of detention by law of vessels or travelers from ports infected with contagious or epidemic diseases outside their ports of destination in order to prevent spreading such diseases. (2) The place of detention, such as Ellis Island in the port of New York, where immigrants are detained and given medical examinations. (3) The act of detention, inspection, and disinfection of suspected vessels and travelers. (4) The modern meaning as indicated by the American Public Health Assn.: the limitation of freedom of movement of persons or animals who have been exposed to communicable disease for a period of time equal to the longest usual incubation period of the disease to which they have been exposed, as regulated by Federal, state, and local health laws. Strict isolation of the patient for the period of communicability of several diseases is still required, and quarantine or immunization of contacts in certain diseases, notably smallpox. Because the terms "isolation" and "quarantine" are frequently used inaccurately and ambiguously, the former has been adopted arbitrarily as describing the limitations put upon the movements of the known sick or carrier individual or animal, and the latter as describing the limitations

imposed upon exposed or "contact" individuals. In cases of common contagious diseases such as measles, mumps, chicken pox, influenza, or the common cold, conditions and extent of isolation are usually left to the direction and discretion of the attending physician.

Quarry (*kwar'y*), a pit, usually open at top or side, from which building stones are cut.

Quart (*kwo't*), a measure of capacity, both dry and liquid, in the English system of weights and measures. In dry measure it contains 67.2 cu. in., is divided into two pints, and is the eighth part of a peck. The quart in liquid measure contains 57.75 cu. in., is divided into two pints, and is the fourth of a gallon.

Quartermaster (*kwo'r'ter-mas'ter*), in military usage, a commissioned officer of a regiment or other body of troops in whom is vested the duty of assigning quarters, arranging camps, providing and issuing clothing and provisions, and furnishing storage and transportation. The quartermaster in the navy is a petty officer who assists the navigator and attends to the steering of the vessel, the compasses, signals, signal apparatus, etc., under the direction of a master.

Quartet (*kwar-tet'*), a musical composition for four voices or four instruments, written on the *obbligato* plan; that is, each part is necessary to maintain the effect of the whole composition. The ordinary instrumental quartet is arranged for the first and second violin, a viola, and a violoncello. Three recognized quartets of singers are in general use, which are called respectively the mixed, male, and female quartets. The *mixed quartet* consists of the soprano, alto, tenor, and bass; the *male quartet* is made up of the first and second tenor and first and second bass; and the *female quartet* comprises the first and second soprano and the first and second alto. Haydn originated the quartet. Many compositions classed as quartets were later written by Mozart and Beethoven. Other great masters adding to this line of music are Schubert, Mendelssohn, Schumann, Spohr, and Brahms.

Quartz (*kwar'tz*), a native oxide of silicon, which occurs either in a massive or crystalline state and varies greatly in luster, transparency, and color. It is diffused abundantly throughout nature in both states. In the massive state it is not pure siliceous, containing various foreign substances, but in the crystalline state it is pure, and is formed of six-sided prisms, terminated by a pyramid at each end. Among the most abundant colors are gray, white or milk, purple, reddish, green, blue, and brownish. It abounds in rocks and is an essential element of granite. Quartz is infusible in the blowpipe flame and resists all acids except hydrofluoric. It is positively electrified by friction and scratches glass readily, and two pieces of quartz may be ren-



Courtesy Brazilian Govt. Trade Bureau, N. Y.

EXAMINATION OF QUARTZ FOR FLAWS

dered luminous by rubbing them together.

Particular names are applied to the principal varieties of quartz, such as common quartz, rose quartz, smoky quartz, milky quartz, rock crystal, yellow quartz, blue quartz, amethyst, hornstone, flint, floatstone, carnelian, Lydian stone, radiating quartz, chalcedony, sapphire quartz, and agate. Quartz enters largely into the manufactures and arts, being employed for making cups, chandeliers, optical instruments, several kinds of glass, and seals. It is important in the manufacture of pottery and porcelain of different kinds, for which purpose it is made into a powder. Quartz veins occur in metamorphic rock, and contain more metals than the masses of rocks through which they are distributed. Gold is found principally in quartz veins or in alluvial sands and gravel, but the quantities taken from alluvial deposits are mere fragments carried by weather and climatic conditions from their natural deposits in quartz veins.

A peculiar characteristic of quartz crystals is the faculty for generating an electrical potential when placed under stress. This faculty makes them important in the manufacture of radios and sound detection equipment. They rank far above other materials for the manufacture of oscillators (used in controlling the frequency of radio transmitters and receivers), of resonators (used at the terminals of cable and long-distance telephone lines), and similar devices.

Formerly, quartz crystals satisfactory for radio manufacture could only be found in Brazil. In recent years, however, deposits have been located in Arkansas, North Carolina, Virginia, and California. See also color plate, *Minerals and Strategic Ores*, in Volume IX.

Quartzite (*kwar'tz'it*), a mineral composed principally of quartz, forming a metamorphic rock. It originated from the alteration of sand-

stone, the grains of which were enlarged by the addition of silica while in a partial state of solution. This gives the appearance of a solidified and uniform rock, but the original rounded surface of the sand grains is revealed by the microscope. In many specimens are traces of iron, mica, and felspar.

Quassia (*kwósh'í-á*), the name of a small tree native to the West Indies and tropical America, so named from Quassi, a Negro, who recommended the bitter bark as a remedy for fever. The bark of the quassia was introduced as a medicine into Europe about the middle of the 18th century, and is now used extensively as a tonic in cases of gastric debility and as a substitute for hops in making beer. When taken in excessive doses, it produces narcotic and irritant effects and sometimes causes vomiting. The wood is useful in cabinetmaking, since it is free from attacks by insects. The quassia bark is obtained chiefly from tropical America and the W. Indies.

Quaternary Period (*kwá-tér'nà-rý*), the division of time which embraces the post-tertiary strata. It is frequently referred to as the *Age of Man*, since it is coextensive with the period of the existence of mankind. In the classification of some writers the terms Quaternary and Pleistocene are used synonymously, while others divide the Quaternary into the two periods of Pleistocene and Recent. See also *Geology*.

Quattrocento (*kwát-tró-chén'tó*), Italian meaning 400, term for the time from 1400 to 1500 which we call the 15th century; primarily the time of the early Renaissance in Italian art.

Quay (*kwā*), MATTHEW STANLEY, politician, born in Dillsburg, Pa., Sept. 30, 1833; died May 28, 1904. He was graduated from Jefferson Coll. in 1850, became a member of the bar in 1854, and entered the U.S. army at the beginning of the Civil War, attaining the rank of colonel. From 1865-67 he served as a member of the Pennsylvania legislature. He was secretary of state from 1873-78 and recorder of Philadelphia from 1878-79. He became state treasurer in 1885 and was elected to the U.S. Senate in 1887, serving for many years. In 1899 he was brought to trial on the charge of having used state funds for personal profit, but the jury rendered a verdict of not guilty. However, the members of the legislature were unable to agree upon re-electing him to the U.S. Senate and adjourned without making a choice, but Governor Stone immediately appointed him to that position. In 1901 he was again elected Senator by the legislature. Quay was long an influential factor in the Republican party.

Quebec (*kwé-bék'*), a province of the Dominion of Canada, formerly known as Lower Canada. It is bounded on the N. by Hudson Strait, N.E. by the coast of Labrador, S.E. by the Gulf of

St. Lawrence, New Brunswick, and Maine, S. by New Hampshire, Vermont, New York, and Ontario, and W. by Ontario and Hudson Bay. The length from north to south is about 2,500 m. and the breadth is 998 m. The area is 594,434 sq. m., of which about 71,000 sq. m. are water surface.

DESCRIPTION. The surface is greatly diversified, and in many localities the natural aspects are wild. The Acadian region of Quebec lies south of the St. Lawrence River and includes a part of the Appalachian Mts., known here as the Notre Dame and Shickshock Mts. They extend along the south side of the St. Lawrence from Quebec to the Gulf of St. Lawrence. Their general elevation is 1,500 ft., but they rise in places to heights ranging between 3,000 and 4,000 ft. A region of lowlands extends along the north side of the St. Lawrence from Quebec to Ottawa.

The principal railways are the Canadian Pacific, the Canadian National and the Quebec Central. Electric railways are operated in the cities and many rural districts. Communication is also provided by 37,000 m. of highways. Its seacoast, extending from its eastern extremity to Montreal, gives Quebec a commercial advantage over other provinces of Canada. Numerous canals have been constructed to facilitate inland navigation. Most important of the canals are the Grenville, the improvement at St. Ours, the Lachine Canal, and the Soulanges Canal, the latter two canals permitting navigation from Montreal to the Great Lakes. The trade, outside of Canada, is largely with Great Britain and the U.S. Among the exports are lumber, livestock, fish, asbestos, and dairy products. Imports include coal, raw cotton, and manufactured goods.

Quebec, on the St. Lawrence, is the capital of the province. Other important cities include Montreal, St. Henri, Hull, Sherbrooke, Lévis, Montmagny, Three Rivers, and St. Hyacinthe. These cities, as well as the quaint countryside, attract a large tourist trade.

GOVERNMENT. Executive authority is vested in the lieutenant governor, who is appointed by the governor general of Canada for a term of five years. He is assisted by an executive council of some dozen members. Both the lieutenant governor and the council are responsible to the legislature. The legislature consists of two chambers, the Legislative Council of 24 members and the Legislative Assembly of 91 members. The former are appointed for life, while the latter are elected every five years by universal suffrage. Quebec is represented in the Dominion House of Commons by not less than 65 members (which is the present representation) and has 24 members in the Dominion Senate.

EDUCATION. The system of public education

QUEBEC

maintained is different from that of other provinces in that separate schools are maintained for Protestants and Catholics. There are about 10,000 schools, and education is free and compulsory for a prescribed period. A superintendent of public instruction is at the head of the schools, but the administration is carried out by two committees, one each for the Protestant and Catholic schools. Both receive support from the public funds, but the religious instruction differs according to the respective schools. Local boards have general charge of the individual schools.

Among the universities located in Quebec are Laval Univ. (Quebec), the Bishop's Coll. Univ. (Lennoxville), McGill Univ. (Montreal), Laval Normal School (Quebec), and the Polytechnic School (Montreal).

INHABITANTS. Quebec was originally settled by the French and the inhabitants are largely French-Canadians. Four-fifths of the population are Roman Catholics. About 10,700 Indians reside in Quebec. In 1931 the total population was 2,869,793; in 1951 it had increased to 4,055,681.

HISTORY. In 1534 Jacques Cartier explored the Gulf of St. Lawrence and claimed the Gaspé Peninsula as a dependency of France. Samuel de Champlain laid the foundation of Quebec in 1608 when he constructed a fortress on the promontory of Cape Diamond, which later became the city of Quebec. The Indians were hostile for many years, and the region fell into the hands of the British in 1629 for a short time. The settlement continued to grow, however, and in 1663 the King of France appointed a royal governor. One hundred years later (1763), the region was ceded to the British by the Peace of Paris, which ended the Seven Years' War.

The Americans attempted unsuccessfully to take Quebec during the American Revolution. The region, generally called Lower Canada, became a province in the dominion in 1867 when the Confederation was organized. Since that time the province has had an almost unbroken period of growth and progress. In 1912 the district of Ungava was annexed to Quebec, making it the largest province in the dominion.

Quebec, the capital of the Province of Quebec, in Quebec County, at the junction of the St. Charles and St. Lawrence Rivers. It is situated about 500 m. from the Gulf of St. Lawrence and 165 m. N.E. of Montreal, occupying a promontory on the north bank of the St. Lawrence. The city is the focus of numerous railroads, including the Canadian Pacific, the Canadian National, and other lines. The highest point of the city is 342 ft. above the river, and access to this section is by elevator, several flights of steps, and a steep but beautiful street.

Many of the streets of Quebec resemble those



Courtesy Canadian National Railways

QUEBEC. ST. JOSEPH'S SHRINE NEAR MONTREAL

of Europe rather than the usual American thoroughfares. The upper part of the city contains the principal residential sections and churches as well as the public gardens. The Plains of Abraham, the site of the famous battle of 1759, are west of the city. Other localities of interest include Montmorency Falls, near which a battle between Montcalm and Wolfe took place, the Chaudière Falls, the three forts of Levis, the shrine of Ste.-Anne de Beaupré, and Beauport. Trade and commerce are centered in the lower part of the city, and near the business section are the manufacturing districts of St. Roch and St. Sauveur.

Communication is furnished by an extensive system of electric railways. Electric power is obtained from Montmorency Falls. Lake St. Charles supplies the city with water.

Quebec is the seat of a large domestic and foreign trade. It has a safe harbor with wharves on both rivers for the accommodation of the largest vessels. Lumber, grain, hides, and merchandise are shipped in large quantities. The important industries include shipbuilding and the manufacture of boots and shoes, leather, hardware, clothing, rubber goods, and steel and iron products.

Laval Univ., founded in 1663, is located at Quebec. Among the other educational institutions are Morrin Coll. (Presbyterian), which is connected with McGill Univ. at Montreal, the Laval Normal School, and the Ursuline Convent. The leading churches include the Anglican Cathe-



BATTLE OF QUEBEC, SEPTEMBER 1759

Courtesy Brown Bros., N. Y.

dral, the Roman Catholic Basilica, St. Andrew's Church, and a number of others. The most prominent public buildings are the houses of Parliament, the county courthouse, the armories, the Chateau Frontenac, the Union Station, and the custom house. Near the riverfront are fine statues of Cartier and Champlain.

The site of Quebec was occupied by an Indian village, called Stadacona, in 1535, when the St. Lawrence was explored by Jacques Cartier. Champlain founded the city in 1608 while exploring that region for France, and it was named Quebec by its founder. Sir David Kirke captured the settlement in 1629 for the English, but it was restored to the French in 1632. The colony was made a royal government in 1663, and Quebec became the capital. In 1759 Gen. Wolfe gained his famous victory on the Plains of Abraham, and since that time the city has been a part of the British Empire. The Americans made an unsuccessful attempt to capture it in 1775. It was the capital of Canada until 1852, when Montreal became the seat of government. During World War II, Quebec was the seat of conferences among American and British high officials. Population, 1951, 164,016.

Quebec Act, an act of the British Parliament, in 1774, which was passed to prevent the Province of Quebec from joining the American colonies in the Revolutionary War. This act extended the boundaries of Quebec so as to include all the Northwest Territory, guaranteed to protect Roman Catholicism as the dominant religion, and permitted the institution of the French civil law. Since the 13 colonies were almost entirely Protestant they looked upon this act with indignation.

Quebec, BATTLE OF, an important battle near the city of Quebec, on the Plains of Abraham. The French under Montcalm, numbering 16,000, held the heights on the north bank of the river and fortified themselves in June 1759. When Gen. Wolfe seized the heights on the south, the

French decided to adopt the defensive plan. The British extended the line of defense by moving their ships past the city, and later landed their forces and entrenched themselves on the French left. The assault at Montmorency and several other points proved futile, but the British gained a decisive advantage on Sept. 13 on the Heights of Abraham, where both Wolfe and Montcalm were killed. This defeat of the French not only caused them to lose Quebec, but their entire possessions in the northern part of America.

Another attack was made upon Quebec at the beginning of the Revolution, which was a part of the scheme of the conquest of Canada. Benedict Arnold was sent against Quebec with an army by way of Maine, while Gen. Montgomery proceeded with another force by way of Lake Champlain and the St. John's River. Arnold reached Quebec on Nov. 13 and Montgomery on Dec. 3, 1775. The combined forces numbered 1,200 men. They made a systematic attack upon the town from opposite sides on Dec. 31, 1775, but were repulsed with considerable loss. Arnold was severely wounded and Montgomery was slain, while Gen. Morgan and a company of Virginia marksmen were taken prisoners. The expedition proved an entire failure.

Queen (*kwēn*), the wife of a king, or the female sovereign of a kingdom. In some monarchies women are excluded from the throne by the Salic law, but in England the succession devolves upon the eldest daughter or female heir apparent, if a deceased sovereign has left no male heir apparent. A *queen consort* is the wife of a reigning king; a *queen dowager* is the widow of a deceased king; and a *queen regent*, or *queen regnant*, is a sovereign princess who has succeeded to sovereign power and holds the crown in her own right.

Queen Anne Style (*kwēn ān stīl*), in art, a term for the English style during the brief reign of Queen Anne (1702-14). This style represents the end of forms that were mostly borrowed from

Holland and Italy, and it opens the way for a more graceful style—comparable with the rising Rococo (*q.v.*) in France—which created especially fine upholstered furniture.

Queen Anne's War. See *War of the Spanish Succession*.

Queen Bee (*kwēn bē*), or MOTHER BEE, member of a bee colony whose duty is to lay eggs, which she can produce at rates up to 100 per hour. If, for any reason, such as old age or weakness, she does not produce the expected number, the colony will raise another queen to replace her. The other bees in a beehive include the drones or male bees, and the workers or undeveloped female bees.

Queen Charlotte Islands (*shār'lōt 7'landz*), an island group in the Pacific Ocean, off the coast of British Columbia, situated north of Vancouver Island. The group includes a large number of islands, but only two are of material importance. These are Graham Island and Moresby Island, which stretch from northwest to southeast a distance of 160 m. They are separated from each other by a narrow channel called the Skidegate Inlet. The former has an area of 3,000 sq. m. and the area of the latter is placed at 1,500 sq. m. Graham Island has a width of 70 m. at the northern extremity, and thence the land mass gradually narrows toward the southeast. The climate is moist, but healthful, and the islands have a considerable growth of magnificent forests. An abundance of minerals occurs in the islands, including iron, copper, anthracite coal, and gold-bearing quartz. By far the largest part of the inhabitants are Indians, who engage in hunting and fishing. The islands belong to the province of British Columbia. Population, 1961, 3,014.

Queen Charlotte Sound, a channel of the Pacific Ocean, which separates the northern part of Vancouver Island from the mainland. It contains many islands, and numerous coast indentations extend from it toward the north and east. Edible fish, especially salmon, are abundant.

Queen (*kwēn*) ELLERY, the pseudonym of two detective story writers, Frederic Dannay, born Jan. 11, 1905, in Brooklyn, N.Y., and Manfred B. Lee, born Oct. 20, 1905, in Brooklyn. Lee, a motion-picture publicity writer, and Dannay, art director of an advertising agency, first collaborated on a detective story in 1929, when they wrote the first Ellery Queen story, "The Roman Hat Mystery." Since that date, Ellery Queen has become one of the most popular of modern detectives. For many years Dannay and Lee concealed the fact that they were Ellery Queen, but eventually the truth became known, as well as the fact that they were also writing under name of Barnaby Ross. Books they have

written under Ellery Queen's name include: "The Greek Coffin Mystery," "The Tragedy of X," "The Tragedy of Y," and "The Tragedy of Z."

Queens (*kwēnz*), one of the five boroughs of Greater New York, coextensive with Queens County, N.Y. It occupies roughly the northern half of the west end of Long Island, across the East River from Manhattan Island, the southern section being occupied by Brooklyn (*q.v.*). It is highly residential, having 201,000 private homes, the greatest number in any of the five boroughs and 54 per cent of the total number of private dwellings in the entire city. Despite this residential character, however, it is also a highly industrialized area, with more than 2,800 manufacturing plants. The borough contains the largest railway express terminal in the U.S., the largest railway passenger-car yards (the Sunnyside yards of the Pennsylvania R.R.), and La Guardia Airport and New York International Airport (Idlewild), two of the largest and busiest airports in the world. It is connected with the mainland by the Triborough and White-stone bridges and the Hell Gate railroad bridge, and with Manhattan by the Triborough and Queensborough bridges, by the Queens-Midtown vehicular tunnel, and by the railway tunnels of the Long Island R.R. and all three of the municipal subway systems. The borough is the seat of Queens Coll. and Queensborough Community Coll. (see *New York, City University of*). Population, 1960, 1,809,578. See also *New York City*.

Queensberry (*kwēnz'bēr-i*), JOHN SHOLTO DOUGLAS, sportsman, born in England, July 20, 1844; died in London, Jan. 31, 1900. He succeeded his father as marquis in 1858 and the following year entered the army, serving until 1864. In 1872 he became a member of the House of Lords, in which he took a more or less active part until 1880. His reputation is based chiefly upon his interests in sports and games. In 1860 he founded the Amateur Athletic Club. He took part in drawing up the *Queensberry Rules*, in 1867, and these are now the basis for contests in boxing and pugilistic exhibitions.

Queensland (*kwēnz'land*), formerly part of New South Wales (*q.v.*), but proclaimed as a separate colony in 1859, is located in the northeastern part of that continent. It is bounded on the north by the Gulf of Carpentaria and the Pacific, east by the Pacific, south by New South Wales, and west by South Australia and Northern Territory. The length from north to south is 1,260 m., and its greatest width is 940 m. It has a seaboard of 3,236 m., being greatly enlarged by the extension of the Cape York peninsula toward the north. The area is 670,500 sq. m.

DESCRIPTION. The Great Dividing Range, which extends along the entire eastern coast of the continent, runs parallel to the coast at a distance



Courtesy Australian News & Information Bureau, N. Y.

QUEENSLAND. MILLAA MILLAA FALLS

of 70 to 100 m. from the sea. From it numerous spurs extend in various directions. The highest peaks range from 3,000 to 5,438 ft. above sea level. The coast region is generally fertile and has an abundance of timber, but the interior and western parts are generally dry and treeless. Chains of islands lie off the eastern coast, which is indented by numerous small bays, including Moreton Bay, the harbor of Brisbane. East of the mainland is the Great Barrier Reef, which is formed largely of coral and is from 20 to 150 m. from the coast. The sheet of water inclosed by it is about 1,200 m. long and contains numerous islets.

The drainage of Queensland is chiefly toward the southwest by the head streams of the Murray River, which discharges into the Southern Ocean, and by streams flowing into the salt lakes in the state of South Australia, though the coast region is drained quite generally into the Pacific and the Gulf of Carpentaria. Among the principal rivers are the Diamantina, Thomson, Barcoo, Georgina, Warrego, and Herbert, flowing toward the southwest; the Brisbane, Burnett, Fitzroy, Pioneer, and Burdekin, flowing into the Pacific; and the Mitchell, Gilbert, Flinders, and Gregory, flowing into the Gulf of Carpentaria. In the western part are extensive treeless plains, but the soil is fertile and produces grasses and shrubs. Here the moisture sinks in the dry ground or collects in lake basins, which evaporate during the dry season.

Queensland is located partly in the Torrid and partly in the South Temperate Zones. The interior is not affected by sea breezes, hence has an ex-

QUEENSLAND

tremely hot and dry climate. At Brisbane, on the Pacific coast, the temperature ranges from 40° to 100° with an average of 70°. Here the rainfall is 50 in., but farther north it ranges from 40 to 150 in. per year. In the western part the temperature is extremely hot and the atmosphere is dry. From 5 to 7 in. of rainfall occur in this section, and all of the state lying west of the Great Dividing Range has an uncertain precipitation.

MINING. Gold is the most important mineral, the fields having been discovered in 1852. Copper, coal, and tin are mined in large quantities, and the output of silver is considerable. Other minerals include mercury, lead, tin, antimony, and salt. Salt is abundant in the lakes and lagoons of the west, where it is deposited in large quantities when the water evaporates during the dry season. Metal mining is confined entirely to the mountain region. Granite, marble, sandstone, and limestone are widely distributed.

AGRICULTURE. Farming is confined largely along the coast, where the soil is fertile and the rainfall is abundant. Sugar cane is the most important crop, and the cultivation of this plant is highly profitable on the rich lands at the mouths of streams flowing into the sea. The other principal crops in order of gross market value are wheat, maize, lucerne hay, cotton, tomatoes, pumpkins, potatoes, tobacco, and peanuts. Many species of tropical fruits, vegetables, and sugar beets are grown profitably. The culture of the silkworm and the mulberry tree has been introduced successfully. While stock is raised profitably on the coast plains, the larger interests in ranching are found in the region of the plains beyond the Great Dividing Range. Queensland exceeds all the other parts of the continent in the number of cattle. It has very extensive interests in sheep raising. Other domestic animals include horses, swine, and poultry. However, the investments in cattle and sheep greatly exceed those of other livestock industries, but the prevalence of drouths sometimes causes the loss of large herds through a lack of water and vegetable growth.

OTHER INDUSTRIES. Queensland maintains a large variety of industries, owing to its varied resources. The forests yield pine, cedar, rosewood, tamarind, myrtle, cypress, red cedar, and bamboos. Gigantic eucalyptus trees abound. It is estimated that about one-half of the surface was originally covered with timber, but the forests on the western slopes are thin or shrubby. Lumbering is a prolific source of income. Pearl fisheries along the coast are important and considerable interests are vested in catching sailfish and deep-sea fish. The manufactures, many of which consist of the processing of primary products, include sugar, flour, butter and cheese, liquors, leather, paper, and lumber products.

Woolen and cotton goods are the leading textiles. Large interests are vested in preserving and packing meat, especially beef and mutton.

TRANSPORTATION AND TRADE. The rivers are not navigable, but many safe harbors are afforded by estuaries and bays. An extensive coastwise trade is facilitated by the long coast line. Railway lines in operation have a total of over 6,500 m. They are built largely from points on the coast to mines and trade centers in the interior, and several lines connect with the railway system in New South Wales and South Australia.

The exports exceed the imports. They include principally sugar, hides, wool, gold, lumber, and frozen meat. Textiles, clothing, machinery, and hardware are imported.

GOVERNMENT. The executive power is vested in a governor appointed by the crown, who is assisted by an executive council composed of the ministers in office. The unicameral Parliament consists of a legislative assembly of 62 members elected for three years by universal suffrage without regard to sex. The right to vote is based upon a residence of six months in the Commonwealth of Australia, three months in the state, and one month in the electoral district, being 21 years of age and a British subject. Local government is administered in the counties and towns, whose officers are elected by the people.

The state extends aid to maintain and extend a system of public education. School attendance is compulsory between the ages of 6 and 14 years, and primary instruction is free and compulsory. Literacy among the inhabitants of Queensland is unusually high. The government encourages secondary education by granting an average of about 4,700 scholarships per year. The state maintains several technical schools and the Queensland Univ. at Brisbane, the capital.

INHABITANTS. The population consists largely of Europeans, including principally English, Irish, Scotch, and Germans. The largest membership is in the Anglican Church. Other denominations well represented include the Roman Catholics, Presbyterians, Methodists, Lutherans, and others. Brisbane, on the southeastern coast, is the capital and largest city. It is located near the Darling Downs, and so has a large trade in grain and livestock. Other cities include Maryborough, Rockhampton, Marlborough, Bundaberg, Cairns, Machay, Toowoomba, Ipswich, and Townsville. Population, 1901, 503,266. In 1906 the state had a population of 535,113; in 1945, approximately 1,075,787.

HISTORY. Queensland was first settled in 1824, when a penal station was established near the present city of Brisbane. It had been explored by Capt. Cook as early as 1770, when he made a chart of the coast from Moreton Bay to Torres Strait, but settlements were not attempted until

the government sent convicts from England. After that free immigrants began to come in, but the larger part of the inhabitants continued to be constituted of criminals. In 1839 the transportation of convicts was discontinued and the country was opened to settlers in 1842. The settlers who came before that time were known as *squatters*.

Queensland was organized as a part of New South Wales and continued to be governed in that way until 1859, when it became a separate, self-governing and economically free colony. Shortly after the discovery of gold many Kanakas from neighboring Pacific islands were imported to work in the mines and on the sugar plantations. Organized labor quickly recognized the threat to wages and living standards in the importation of what was virtually slave labor. It fought the issue bitterly over a number of years and a Labor government finally introduced legislation fixing wage levels that made it impossible for employers to continue the use of Kanaka labor. Both the Commonwealth and Queensland governments participated in a scheme which resulted in the Kanakas being returned to their islands.

The colony became a member of the Australian federation in 1901 when it ratified the constitution of the Commonwealth. Today Queensland is one of Australia's most prosperous states. Primary industries are still its backbone, although in Brisbane, where there are no clearly defined industrial suburbs, factory workers number more than 23,000 out of a population of approximately 318,430. The industrial output of the state increased enormously during World War II, and competent judges consider that Queensland has a promising future. Magnificent scenery combined with a pleasant climate appeals to the sightseer, and the sportsman has a choice of practically everything ranging from big game fishing to wild buffalo hunting in the extreme north. See also *Australia*.

Queenston Heights (*kwēnz'tūn hīts*), **BATTLE OF**, an engagement of the War of 1812, which took place at Queenston Heights, in Ontario, near Niagara Falls, on Oct. 13, 1812. The British and Canadian troops under Gen. Brock were encamped on an eminence overlooking the Niagara River, while Gen. Van Rensselaer and 700 Americans were stationed at Lewiston, opposite the village of Queenston. The latter had been promised reinforcements and was charged with the duty of invading Canada. On the morning of Oct. 13, the Americans crossed the river and made an attack, but their movements were detected by the British, who were compelled to fall back toward the village of Queenston. Although the Americans at first were successful, the expedition proved a failure, since Van Rensselaer was not supported by the other American commanders, who pleaded

that they were not to leave the soil of their own country. The Americans lost 190 killed and 900 prisoners, while the British lost a total of 130. Gen. Brock was slain in action. A monument was erected to his memory upon the battle ground by the province of Ontario. See *Niagara Falls*.

Queen's Ware (*kʷēnz' wār*). See *China-ware*.

Quelpaert (*kʷəl'pärt*), or **TAMRA**, an island off the southern coast of Korea, about 60 m. from the mainland. The shores and surface are more or less rocky, but tracts of considerable extent have great fertility. The island is 40 m. long and 17 m. wide, and the area is about 780 sq. m. Mt. Auckland, the highest point (6,558 ft.), is an extinct volcano. The chief products are rice, fruits, fish, cattle, and silk textiles. Chyei Chyu is the chief town and capital. For the purpose of government is belongs to Korea, and had been under the jurisdiction of Japan from 1910 until the Sino-Japanese War when Korea fought on the Chinese side against Japan. Population, *ca.* 130,000.

Querétaro (*kā-rā'tā-rō*), a city of Mexico, capital of a state of the same name, 110 m. N.W. of the City of Mexico. It is situated on a plateau 5,904 ft. above sea level, has good railroad facilities, and is surrounded by a fertile region. Querétaro has factories that produce cotton and woolen goods. Among the other manufactures are leather, machinery, clothing, tobacco and cigars, earthenware, and utensils. Opals are mined near the city. Querétaro is well built and its streets intersect each other at right angles. It derives its water supply from an aqueduct about 10 m. long, which is supported a part of the distance upon arches 90 ft. high. Among the principal buildings are several fine churches, a number of educational institutions, and the government buildings. The city was founded by the Aztecs about 1440. Emperor Maximilian was besieged at Querétaro by the republican forces and was shot here on June 19, 1867. Population, *ca.* 35,000.

Quern (*kʷērñ*), a hand mill for grinding grain, used before the invention of water or windmills. It consisted of two circular stones, the upper of which was pierced in the center with a narrow funnel and the lower was slightly dished. A wooden or metal pin was inserted in the lower stone, on which revolved the upper when turned by means of a stick thrust into a notch in the edge. The grain was dropped with one hand into the central opening as the upper stone was turned with the other. Devices for grinding grain in this manner are of great antiquity, as is evidenced by remains of querns dug up wherever regions were populated by Asiatic or European people. In some sections of Ireland, in the Shetlands, and in the Hebrides querns are still used to a limited extent. Specimens of querns

now in the museums of Rome and other European cities give evidence that they were employed very extensively in the Roman period. Those dating from that time contain ornamentations of various Roman devices.

Quesada (*kā-sā'thā*), XIMENES DE. See *Ximenes de Quesada*.

Quesnay (*kē-nā*), FRANÇOIS, economist, born in Mérey, France, in 1694; died in 1774. He was a physician, and numbered among his patients the Duke of Villeroy and the King of France. However, he is best known for his economic theses which appeared in the "Encyclopédie." He is credited with founding the politico-economic school called the Physiocrats. His other writings include: "Tableau Economique" (1758), "Maximes" (1758), and "Physiocratie" (1768).

Quetzal (*kēts'āl*), or **QUESAL**, the name of a bird native to Central America, belonging to the trogon family. In size it resembles the magpie, but the tail coverts of the male are greatly elongated, usually from 20 to 30 in. It clings to the limbs of trees similarly to the woodpecker, since its feet are not well adapted to walking. The male is richly colored and has fine plumes on the wings, while the female is less attractive. This bird has been adopted as the national symbol of Guatemala.

Quetzalcoatl (*kēts-āl-kō-āt'l*), the mythical hero and king of the Aztecs, who was worshipped as the god of commerce and the industries. It is supposed that he resided in the ancient city of Tula, or Tollan, about 40 m. N. of the present City of Mexico, and extended the influence of the Toltecs, so named from their chief city, over a large tract of country through peaceful means. According to some writers he predicted the conquest of Mexico by the Spaniards.

Quezaltenango (*kā-sāl-tā-nān'gō*), a city of Guatemala, Central America, capital of a province of the same name, 68 m. N.W. of Guatemala City. It is situated on an elevated tableland and has a fine cathedral and several government buildings. Among the manufactures are cotton and woolen goods. Alvarado founded the city in 1524. Population, *ca.* 30,000.

Quezon y Molina (*kā'són ē mō-lē'nā*), MANUEL LUIS, statesman, born in Baler, P.I., in 1878; died in 1944. Educated in Manila, where he received a law degree at the Univ. of Santo Tomás, Quezon saw service in the Philippine army (1898-1900) before being admitted to the bar in 1903, and entering upon a political career. He first held public office as a member of the Philippine Assembly (1907-09) and was later appointed Philippine commissioner in the Congress of the U.S. (1909-16). He served as president of the Philippine Senate (1916-35), and was elected president of the Commonwealth of the Philippines in 1935. Despite ill health, he headed the coura-



Courtesy Underwood & Underwood, Wash., D. C.

MANUEL QUEZON

geous Philippine government-in-exile after the Japanese occupation of the islands (1942) at the beginning of World War II.

Quichua (*kê-chōō'a*), the name of one of the four divisions into which the ancient Peruvians were divided, the others being the Changos, the Atacamas, and the Aymares (Incas). Each of these families spoke a distinct language, but those of the Quichuas and the Incas were quite similar, and therefore some writers regard them as dialects of a common tongue. The Quichuas became subject to the Incas and constituted the more powerful class in their empire, occupying Cuzco, the capital, and a vast extent of the surrounding country. At present their descendants constitute about three-fourths of the Indian population of Peru and Bolivia, where their language is still spoken by a large number. These people are small in stature, but have broad chests and are capable of enduring long and severe exertion. The skin is olive-brown or bronze, instead of being coppery like that of the Indians of North America. Previous to the conquest they had made considerable progress in science. They observed the solstices and equinoxes, had a decimal system of numeration, and cultivated music and poetry.

Quicksands (*kwik'sānds*), masses of loose and moving sand found at the mouths of rivers and on many seacoasts. They are formed on flat shores over beds of stiff clay through which water cannot penetrate, thus constituting a loose mixture of sand and water. Quicksands frequently occur in the vicinity of curves in narrow channels. In the latter case sand is carried by strong tidal currents to a favorable locality, where it is kept in a loose condition by moving water. Though not commonly of great extent, quicksands are dangerous to vessels or to persons, since they form an obstruction to passage and are so permeated with water that they are incapable of sup-

porting the weight of a person. Quicksand is a term applied frequently to strata of loose sand, which usually carry large veins of water.

Quicksilver (*kwik'sil-vēr*). See *Mercury*.

Quidde (*kvid'ē*), LUDWIG, historian and pacifist, born Mar. 23, 1858, in Bremen, Germany; died Mar. 4, 1941, in Geneva, Switzerland. He was educated at Bremen, Strasbourg, and Göttingen. As early as 1892 he became a leader in the German peace movement, founding the Munich Peace Society in that year. He entered politics in 1901, when he became a member of the Municipal Council of Munich. Later, he served in the Bavarian Second Chamber (1907-18) and in the National Assembly of Weimar (1919-20). For many years, before World War I, Quidde, the pacifist, had attacked the militarism of the Kaiser and in 1913 he was exiled for this. He lived in Switzerland during World War I. He served as president of the German Peace Society (1914-29), as president of the German Peace Cartel from 1920-29, and in 1920 also became vice president of the International Peace Council in Geneva, of which he had been a member since 1901. He shared the Nobel Peace Prize for 1927 with Ferdinand Buisson. When Hitler came to power, Quidde again left Germany for Switzerland, where he lived until his death. He wrote: "Caligula" (1894), "League of Nations and Democracy" (1920), and "League of Nations and Peace Movement" (1920).

Quiller-Couch (*kwil'ēr-kōōch*), ARTHUR THOMAS, author, born in Cornwall, England, Nov. 21, 1863; died in 1944. He studied at Clifton Coll. and Trinity Coll., Oxford, being graduated with high honors. After taking his degree, he was classical lecturer at Oxford for two years, and, in 1912, he joined the faculty of Cambridge Univ. as King Edward VII professor of English literature. In 1937 he was elected mayor of Fowey. His writings portray a vivid imagination, mastery of style, and critical study of the subjects treated. Many of his writings were published under the pseudonym Q. Among his books are: "The Blue Pavilions," "A Procession of English Lyrics from Surrey to Shirley," "Dead Man's Rock," "The Ship of Stars," "The Adventures of Harry Revel," and "Q's Mystery Stories."

Quillota (*kēl-yō'tá*), a city of Chile, on the Aconcagua River, 23 m. N.E. of Valparaiso. It is one of the oldest cities of Chile and has railroad facilities. The surrounding country is rich in minerals, especially copper. It has a number of educational buildings, several churches, and a considerable trade. The city suffered severely from earthquakes in 1822 and 1851. Population, ca. 13,000.

Quin (*kwīn*), JAMES, actor, born in London, England, Feb. 24, 1693; died in Bath, Jan. 21, 1766. He was of Irish descent and made his first

appearance on the stage at Dublin in 1714, but soon appeared at the Drury Lane Theater in London. His eminence rested largely on his ability as a tragic actor, but he was likewise efficient in characters of a comic and sarcastic nature. In 1717 he engaged at Lincoln's Inn Fields, where he played the part of principal actor for 17 years, and in 1734 returned to Drury Lane. Quin remained the most eminent actor in Great Britain until the appearance of Garrick, in 1741, and 10 years later withdrew from the stage to his permanent residence at Bath. Among the plays in which he took a prominent part are "Tamerlane," "Beggar's Opera," and as *Falstaff* in the "Merry Wives of Windsor." It is thought that he has never been excelled in the role of *Falstaff*.

Quince (*kwins*), a tree of the apple family. It is native to the western part of Asia, but has been naturalized in many regions and is cultivated extensively for its fruit. The tree seldom exceeds a height of 20 ft. It has oval leaves, irregular branches, and white or pale red flowers. The fruit grows singly on young branches and has a yellow or orange color. When plucked from the tree it is hard and too austere to be eaten, but is valuable for boiling in sugar or to be made into preserves or jelly. A kind of preserve made from quinces is called *marmalade*. Quinces are used in making a beverage similar to cider. The seeds are demulcent and mucilaginous and are used to some extent in medicine. The *Japan quince* is a small tree, about 6 ft. high, and is cultivated chiefly for its early and large, profuse flowers. The Greeks and Romans cultivated the quince extensively. At present it is grown in many sections of America and Europe.

Quincke (*kwĩng'kē*), GEORG HERMANN, physicist, born at Frankfort-on-the-Oder, Germany, Nov. 19, 1834; died Jan. 13, 1924. He was granted the degree of doctor of philosophy in 1859, and later investigated the laws governing the reflection of light from metallic and other surfaces.

Quincy (*kwĩn'sĩ*), a city in western Illinois, seat of Adams County, on the Mississippi River, 104 m. w. of Springfield. It is served by the Chicago, Burlington & Quincy R.R.; Baldwin Field, the municipal airport, is 10 m. e. of the city. Quincy is the site of Quincy Coll., the Historical Society of Quincy and Adams County, and Illinois Soldiers and Sailors Home. Nearby are Siloam Springs State Park and Mark Twain National Wildlife Refuge. An industrial and commercial center, Quincy has diversified manufactures including chemicals, stoves, castings, electric wheels, auto and truck bodies, pumps, feed, oil-drilling machinery, gas storage tanks, boat trailers, electronic equipment, and limestone, food, brass, and paperboard products. Quincy is also the center of a large agricultural region, which produces grain,

fruits, vegetables, livestock, poultry, and dairy products. The site was settled in 1822 as Bluffs and renamed Quincy in 1825; it was incorporated as a city in 1840. The sixth in the series of debates between Abraham Lincoln and Stephen A. Douglas was held here in 1858. In 1900 Quincy's population was 36,252; in 1940, 40,469; in 1950, 41,450; in 1960, 43,792.

Quincy (*kwĩn'sĩ*), a city in eastern Massachusetts, in Norfolk County, on Quincy Bay between the Fore and Neponset rivers, ca. 8 m. s. of Boston. It is served by the New York, New Haven & Hartford R.R. It is the site of Adams Acad. (which stands on the site of John Hancock's birthplace) and Eastern Nazarene Coll. The birth and burial places of Presidents John Adams and John Quincy Adams are here, as is the Adams Mansion, a national historic site. Other points of interest include the Miles Standish Cairn, the Josiah Quincy house (1770), the Dorothy Quincy house (1706), the site of an iron furnace (1643), the Swingle Quarry with which was connected the first commercial railroad in America (1826), and the First Parish Church (1828). Quincy's industries include shipbuilding, printing and publishing, and the manufacture of electrical and other machinery, primary and fabricated metal products, food products, and rubber and plastic products. It is part of the Boston standard metropolitan statistical area. The city alone had a value added by manufacture in 1958 of \$177,325,000. Settled in 1625, the site was part of Braintree until 1792, when it was detached, incorporated, and named Quincy. It was incorporated as a city in 1888.

Population, 1950, 83,835; in 1960, 87,409.

Quincy, JOSIAH, lawyer, born in Boston, Mass., Feb. 23, 1744; died Apr. 20, 1775. He was gradu-

JOSIAH QUINCY



ated from Harvard Coll. in 1763, and attained high rank as a lawyer. He denounced the Stamp Act and other measures imposed by Parliament upon the colonists in a series of articles in the *Boston Gazette*, which he signed "Hyperion." In 1770 he and John Adams defended Capt. Prescott and the British soldiers implicated in the Boston massacre, on Mar. 5, 1770, though neither of these men was in accord with the policy of the government. He published an able work in 1774, entitled "Observation on the Boston Port Bill," and in the same year went to England as a confidential agent of the colonists with the view of strengthening the American cause. His death occurred while on the return journey to America, off Gloucester, Mass. Quincy was eminent for his ability as a lawyer and his gift of oratory.

Quincy, JOSIAH, author and statesman, son of the former, born in Boston, Mass., Feb. 4, 1772; died there July 1, 1864. He was graduated from Harvard Coll. in 1790, took a law course, and became a leading member of the Federal party. After serving in the Massachusetts legislature, he was elected to Congress in 1804, where he was distinguished as an orator and opponent of the policy of Jefferson and Madison. Among his most noted speeches are those against slavery and in opposition to the Embargo Act and the Louisiana Purchase. He declared the latter to be sufficient cause for the dissolution of the Union. He remained a member of Congress until 1813, when he declined re-election because of the overwhelming success of the Democratic party and the War of 1812, and devoted his attention principally to agriculture. However, he entered the senate of Massachusetts a few years later, was mayor of Boston from 1823 to 1828, and served as president of Harvard Univ. from 1829 to 1845, in which capacity he introduced a system of marking on which college rank was based, and installed a large telescope. Among his principal writings are: "History of Harvard University," "History of the Town and City of Boston," "Essays on the Soiling of Cattle," and "Life of John Quincy Adams."

Quinine (*kwī'nin*), an alkaloid, $C_{20}H_{24}O_2 \cdot 3H_2O$, found in the bark of the cinchona tree. It is a white powder of extremely bitter taste. It is extracted by the use of hot paraffin oil from ground cinchona bark mixed with lime, and purified by further treatment. It is used in medicine as a drug for the treatment of malaria and feverish colds, in preparations for preventing sunburn, and in tonics.

Quinicine or **quinotoxine**, $C_{20}H_{24}O_2N_2$, an isomer of quinine, had been produced from quinine by Pasteur. In 1918, Rabe, a German chemist, succeeded in reconverting quinotoxine into quinine. In 1944, Robert B. Woodward and William E. Doering, of the universities of Harvard

and Columbia, respectively, succeeded in synthesizing quinotoxine from a coal-tar derivative, 7-hydroxyiso-quinoline. Having produced quinotoxine, it was converted into quinine by the use of Rabe's method, and the synthetic production of quinine was thus made possible.

Quinoa (*kwī-nō'ā*), an annual herb native to the tropical parts of America, closely allied to and resembling the common pigweed. It attains a height of from 4 to 6 ft. and yields a white seed of value as food. The plant is cultivated in Chile, Mexico, and other countries, where its seed is ground and used in making cakes, porridge, and other articles of food. The *red quinoa* is a closely allied species and yields red seeds containing medical properties used in treating bruises and sores. The quinoa plant has been naturalized in Europe, where the leaves are used as a substitute for spinach and the seeds serve as food for poultry.

Quinquagesima (*kwīn-kwā-jēs'i-mā*), from the Latin *quinquaginta* meaning 50, the Sunday before Ash Wednesday, occurring 50 days before Easter.

Quinquennium (*kwīn-kwēn'i-ūm*), from the Latin *quinque* meaning five, term designating a period of five years.

Quinsy (*kwīn'zī*), or PERITONSILLAR ABSCESS, PERITONSILLITIS, QUINSY SORE THROAT, an acute suppurative (pus-producing) inflammation of the soft tissue of the throat in the regions of the tonsils. This condition occurs more frequently in young adults, being relatively rare in children and older adults. Because the inflammation involves the connective tissue around the tonsils (*i.e.*, the tonsil beds) rather than the tonsils directly as in common tonsillitis, the disease is sometimes called peritonsillitis. The adjacent regions of the soft palate, uvula, pharynx, and base of the tongue are frequently involved also. Quinsy may develop as a complication of simple tonsillitis, but most often occurs in those with chronically infected cryptic tonsils, with the *Streptococcus haemolyticus* almost invariably the infectious agent. There is no immunity after one attack, and subsequent attacks are frequent. The condition may occur on one or both sides of the throat, with early symptoms of sore throat, mild fever, general malaise, and irritability. Great pain may develop on the affected side, often extending to the ear; swallowing may become painful, the head is held rigidly, and there is copious secretion of saliva. The throat and palate become very red and swollen. If untreated, an abscess forms and usually ruptures, within about a week, in the area between the upper tonsillar pillar and the uvula. Complications of quinsy, if properly treated, are rare. Treatment includes symptomatic relief by ice-bags about the neck, hot antiseptic gargles, analgesic medication for pain relief, and

early surgical incision and drainage of the abscess area in order to hasten relief and recovery. Local and systemic penicillin therapy has proven effective. After complete recovery, tonsillectomy (surgical removal of tonsils) is indicated for prevention of subsequent attacks.

Quintilian (*kwin-til'i-an*), MARCIUS FABIUS QUINTILIANUS, Roman advocate and rhetorician, born at Calagurris, Spain, in 36 A.D.; died about 118 A.D. He was the son of a teacher of rhetoric, studied at Rome under Domitius Afer, and became noted as a Roman advocate. From 61 to 68 he resided in Spain, but in the latter year he accompanied Galba (*q.v.*), the future emperor, to the Roman capital. For nearly 20 years after the accession of Galba he was noted as a teacher of rhetoric and oratory, and among his students were such eminent men as Pliny the Younger and the two grand-nephews of Domitian. Emperor Domitian conferred upon him the consular dignity, and he attained to distinction as a pleader in the courts. He retired to private life about the year 89 to devote his attention to his great work, entitled "De Institutione Oratoria," a treatise on rhetoric in 12 volumes. It was written in a period of two years, contains an elaborate treatise on rhetoric, and includes valuable criticisms and opinions of Greek and Roman writers.

Quintuplets (*kwin'tu-plĕts*). See *Dionne Quintuplets*.

Quipu (*kĕ'pōō*), an aboriginal device for recording and conveying information, formerly used in various parts of Asia, Africa, and Amer-

ica. It consisted of a series of colored and knotted strings tied at one end to a thicker cord, and the order, color, and knots of the strings were used like elements of a written language. The earliest instrument of this kind is said to have been invented by Emperor Suy-yin of China, and the Chinese are thought to have used quipus until this form of keeping records was superseded by the art of writing. The Incas of Peru used quipus at the time those regions were invaded by the Spaniards. In some instances these devices were used for preserving accounts of historic events.

Quirinal (*kwi'r'i-nal*), one of the seven hills occupied by the ancient city of Rome, located a short distance north of the Palatine. West of it is the Campus Martius, which extends to the Tiber. In the time of the ancient Romans it contained a shrine of Fortuna, the temples of Quirinus and Flora, and the great baths of Diocletian and Constantine. Pope Gregory XIII began the building of the Quirinal Palace in 1574. This structure was a summer residence of the Popes until 1870, when it became the Italian royal residence. It is decorated with beautiful works of art, including Overbeck's painting commemorating the flight of Pius IX, in 1848.

Quirinus (*kwi-r'i-nūs*), one of the gods in the religion of the early Romans, ranking next to Jove and Mars. He represented the god of war during the time of peace, being in some respects parallel to Mars, who was looked upon as the war god at all times. Some writers think that he was identical with Romulus, who was honored

QUIRINAL PALACE, ROME

Painting by Antonio Canaletto (1697-1768)



by the festival of Quirinalia, which occurred annually on Feb. 17, that is, the 13th day before the Kalends of March in the Roman system. The temple of Quirinus was located on Quirinal Hill.

Quirites (*kwi-rī'tēz*), the name used by the Romans to designate the civil capacity of their citizens, while *Romani* indicated the military and political relation. Although the term was a title of honor in the nation, the Quirites were looked upon with reproach in the army, since the soldiers regarded them as fit only for civilians.

Quisling (*kwi's'ling*), VIDKUN, politician, born in Norway in 1887; executed, October 1945. Quisling held various positions in the Norwegian diplomatic and intelligence services in the years following World War I, and in 1931 was given the post of minister of defense, from which he resigned in 1932 to organize a political party called the National Union which was dedicated to the suppression of Communism and labor-union groups in Norway. He was an active collaborator in the German invasion of his country in 1940, and was later rewarded by the occupation authorities, becoming head of a puppet government. After Norway was liberated Quisling was indicted for intelligence with the enemy, sentenced, and executed in October.

For his treachery exhibited in the course of the German aggression, his name has become a byword for persons collaborating with or otherwise aiding enemies in one's country.

Quitclaim (*kwi't'klām*), the name of a deed in which the grantor or seller of real estate conveys to the grantee or buyer all his right, title, interest, and estate without any warranty whatever of the title or quantity. The formal words employed in such an instrument are "remise, release, and forever quitclaim."

Quito (*kē'tō*), the capital and largest city of Ecuador, in the province of Pichincha, near the eastern slope of the volcano of Pichincha. It is situated about 9,350 ft. above sea level. Its pleasant and temperate climate and its location in a picturesque valley make it one of the most beautiful cities of South America. The atmosphere is almost constantly clear and bracing. Its principal streets are wide and well planned, but those in the older parts of the city are narrow and steep. Transportation now includes railways, electric trolleys, buses, motorcars, and air service. Among the important buildings are those maintained by the government, including the capitol, the president's palace, and the courthouse. The Univ. of Quito is the principal educational institution, but there are numerous schools and convents, as well as a state theater, a seminary, an observatory, several hospitals and asylums, museums, libraries, and churches. The cathedral is beautifully decorated, and, like much of the city's architecture, shows the Spanish influence. The remains of forts

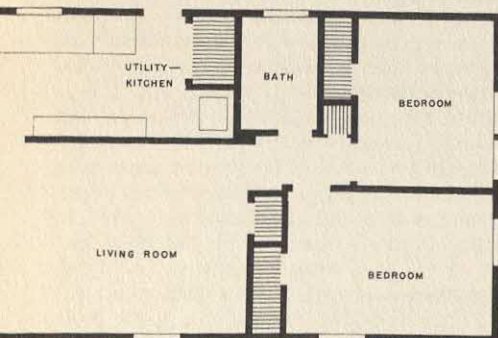


Courtesy Grace Line

STREET SCENE IN QUITO

and temples of the ancient Incas are still to be found in the vicinity. Quito is the seat of an archbishopric. Among the manufactures are cotton and woolen goods, liquors, jewelry, religious images, hosiery, thread, lace, and utensils. The city was founded by the Spaniards in 1534 and suffered at various times from earthquakes, particularly in 1859, when many lives and about \$3,000,000 worth of property were lost. The inhabitants consist principally of descendants of Spaniards and Indians, but also include many pure-blooded Spaniards and Indians. Population, ca. 150,000.

Quoits (*kwoits*), a game in which the player strives to pitch a ring, usually somewhat flattened, so as to encircle a peg or hob struck upright in the ground. The rings measure from 8 to 10 in. in external diameter, the rim being from 1 to 2 in. wide. Two pegs or hobs of wood or iron are set upright in the ground, usually 18 yds. apart, and the player who gets the greatest number of quoits nearest the pegs is the winner. Each player has two quoits, which are pitched alternately. If a player pitches a quoit nearer the hob than either of his adversary's, he gains one point; if both his quoits are nearer than those of his adversary, he scores two points. If a quoit leans against the peg, it counts three, but if it encircles the peg, it scores five. However, if both players encircle the peg with one or both of the quoits, only the upper one is counted. Horseshoes are used extensively in playing this game. Each side may consist of one or two players.



Quonset Hut (*kʷŏn'sēt hūt*), trade name for a dwelling developed during World War II, now called "Arch-Rib" house. Usually built of prefabricated steel, it has a semicircular end shape, and consequently has low walls and a curved ceiling. Used as barracks, they were capable of accommodating as many as 50 persons. Since the end of the war they have been used extensively in low-cost permanent housing units, as well as for temporary housing units at many colleges and universities.

Quorum (*kʷō'rŭm*), the name applied to such a number of persons of any deliberative or corporate body as is necessary for the legal transaction of business. If no specific rule as to the number required has been adopted by the body, a quorum consists of a majority of the members. It is customary for most bodies to adopt rules providing that a majority of the members shall constitute a quorum, though a greater number may be required for special purposes, and in some bodies less than a majority may be made a quorum by a rule. For instance, 40 members constitute a quorum in the British House of Commons. The Constitution of the U.S. provides that a majority of each house of Congress shall constitute a quorum to do business, but a smaller number may adjourn from day to day, and may instruct the sergeant-at-arms to compel the attendance of absent members. It was held during the first 50 Congresses of the U.S. that the Constitutional quorum must be shown to be present by the count of votes, but in 1890 Thomas B. Reed, then speaker, ruled that he might decide a quorum to be present when enough members were visibly present, though some did not vote. This position has since been generally supported and it is now held that if a majority be present to do business, their presence is all that is required to make a quorum in either house of Congress.

Quo Tai-Chi (*kʷō' tī' chē'*), diplomat, born 1889. Educated at the Univ. of Pennsylvania, he served as counselor to Sun Yat-sen (*q.v.*), 1821-22. He then held numerous government positions, being appointed foreign minister in 1941, and becoming the Chinese member of the United Nations Security Council in 1946.

Quo Vadis (*kʷō vā'diz*), title of a novel by H. Sienkiewicz (1846-1916), Polish writer. "Quo Vadis" deals with the persecution of the Christian martyrs in the days of Nero and is one of the author's best-known works.

Courtesy Great Lakes Steel Corp., Detroit, Mich.

ADAPTATION OF THE "QUONSET" HUT

(Left, top to bottom)

Steel arch-rib frame; completed low-cost permanent housing unit patterned after the "Quonset" hut developed during World War II; floor plan of the above unit



R (*är*), the 14th consonant and 18th letter of the English alphabet, which is classed as a semivowel and a liquid. It is generally considered to have two sounds; one at the beginning of a word or syllable, or when it is preceded by a consonant, and the other at the end of a word or syllable, or when it is followed by a consonant. In the former case it is pronounced by an explosion of vocalized breath, the tongue almost touching the palate or gum near the front teeth with a tremulous motion, and in the latter it is formed by a vibration of the lower part of the tongue, near the root, against the soft palate. The former use is illustrated by such words as *tree*, *ran*, and *morose*; and the latter by the words *her*, *star*, and *beard*. The *Three R's*, a term familiarly used to designate the three elementary subjects of education, reading, writing, and arithmetic, originated with Sir William Curtis. In this relation they are often spoken of as *reading*, *'riting*, and *'rithmetic*.

Ra (*rä*) or **RE**, the chief deity of ancient Egypt. The pantheon of Egyptian gods was very complicated and inconsistent, and the identities of gods were often merged and confused. Thus Ra is sometimes identified with such other gods as Horus and Amon. He was also called by other names: *Khepara*, or *Khepere*, when considered as the morning sun; *Atum*, or *Tem*, when considered as the setting sun. He was often represented with the head of a hawk or falcon; and the solar disc (*Aten*), the obelisk, and the scarab were all used as his symbols. The center of his worship was Heliopolis. When Pharaoh Amenhotep IV (*q.v.*) attempted to establish monotheism in Egypt, it was the sun god, in the form of Aten, that he worshiped.

Rab (*räb*), a Yugoslav island and resort at the head of the Adriatic Sea. Marble quarrying and

the manufacture of silk textiles are the main industries. Its area is *ca.* 45 sq. m. Population, *ca.* 8,500.

Rabat (*rä-bät'*), a maritime city and the capital of Morocco, in the province (area, 4,460 sq. m.; pop., 1954, 406,669) of the same name, *ca.* 65 m. N.W. of Casablanca. Commerce is handicapped by the shallowness of the city's harbor, the silt-filled mouth of the Bou Regreg River. Manufactures include cotton and woolen goods, carpets, and leather goods. An outstanding architectural feature is the Hassan Tower, erected in the 12th century, the century in which the city was founded. Population, *ca.* 160,000.

Rabaul (*ra-boul'*), a seaport of New Britain, largest island of the Bismarck Archipelago in the Territory of New Guinea (administered by Australia under a U.N. trusteeship). The Japanese made Rabaul their chief naval and air base in the southwest Pacific during World War II, and it was a prime target for the Allies. The town is surrounded by active and extinct volcanoes. Population, *ca.* 2,950.

Rabbah (*räb'ä*) OF RABBATH, the Biblical name of the city of Amman (*q.v.*).

Rabbi (*räb'bi*), a Hebrew word meaning "my master," "my teacher," a title applied to persons having judicative and other special authority among the Hebrews. The title was in common use among the Jews in the time of Christ, who was thus addressed by His disciples. During the last decades of the second Temple, the scribes were addressed as "rabbi," as a quasi-honorary title. It is now applied to any teacher who is not a priest, especially to learned doctors of the Jewish law, to the Jewish clergy, so to speak. Although in Eastern Europe individual rabbis conferred the title upon others they deemed worthy,

RABBIT

in Central and Western Europe as well as in the U.S. the title, corresponding somewhat to the degree of D.D., is conferred by a number of Jewish colleges and seminaries.

Rabbit (*rāb'it*), a small mammal of the genus *Oryctolagus*, in the order Lagomorpha (*q.v.*). Outstanding characteristics of the rabbit include big ears, large eyes, long hind limbs and feet, and a short tail which flashes white when the animal makes a hasty retreat. Its senses are well developed, and it has almost spherical vision.

The rabbit is a sociable animal, and colonies live together in a "warren" or community burrow. Unlike the other members of the family Leporidae, the rabbit lives underground and brings forth its young in a very incomplete stage of development. The breeding season begins in February and ends in September; the female, or doe (the male is called a buck), may have from four to eight litters annually, with from three to nine young in each. The gestation period is from 28 to 30 days. The young rabbits are fully clothed and able to run in two weeks; they are on their own in a month and ready to mate in six weeks. The life span of a rabbit is seven or eight years.

The rabbit feeds on grass and most kinds of vegetable matter, coming out of its den at dusk and running in and out until early morning. It follows well-worn trails to and from the feeding grounds. Attaining a maximum speed of 35 m.p.h., it tires after the first 50 or 80 yd. The animal's normal gait is a standard hop; it can go into high speed in one leap and stop as suddenly.

A native of central and southern Europe and North Africa, the rabbit was introduced into England, Australia, New Zealand, and many other islands. When introduced into Australia, where its natural enemies (*e.g.*, fox, stoat, weasel, badger, wild cat, polecat, marten, golden eagle, goshawk) were few or lacking, the rabbit increased so rapidly that it menaced agriculture, grazing land, and orchards, and it was controlled only by introducing a virus deadly to rabbits but harmless to other animals.

Domestic breeds, *e.g.*, the Flemish Giant, the Belgian hare, the Angora rabbit, the Lop-eared rabbit, and the other fancy breeds, were developed from the common European rabbit.

The animal is of considerable economic importance. Its flesh is a valuable source of food; the fur is one of the principal factors in the manufacture of felt; and the pelt is dyed and trimmed and used in place of more valuable fur.

Rabelais (*rā-b'lä'*), FRANÇOIS, great satirical writer, born in Chinon, France, about 1490; died at Paris in 1553. The facts of his early life are disputed, but it is certain that in 1519 he entered the Convent of Fontenay le Comte as a member



FRANÇOIS RABELAIS

of the Order of St. Francis. While there, he devoted himself with much ardor to the study of Latin and Greek and many modern languages, including Italian, German, Spanish, Hebrew, and Arabic. In 1530 he was admitted as bachelor and shortly after began the study of medicine at Montpellier, where he secured a medical degree in 1537 and received an appointment as lecturer. In 1532 he was engaged as hospital physician at Lyons, where he published several works bearing on medicine and jurisprudence. He visited Rome with the Bishop of Paris, Jean du Bellay, whom he accompanied as traveling physician, and, after returning to France, continued the practice of medicine at Montpellier. In 1546 he settled as physician at Metz, and he may have received an appointment as curé of Meudon in 1551. He resigned this position in 1552.

The treatises of Rabelais on scientific subjects have long since been forgotten, but his novels, "Pantagruel" (1533) and "Gargantua" (1535), continue to be classed among the most humorous and grotesque masterpiece of the world. The works appeared in five books, but the fifth was left in manuscript. Rabelais is generally credited with a happy and blameless life, one devoted to the relief of suffering and the spread of culture. His publications place him before us as a reformer of social abuses practiced in his time, and they may be regarded as satirical criticisms of the corrupt state of society of his age. Charges of irreligion and atheism were preferred against him and his works at different times, but there seems to have been little or no ground for such inferences, since his writings were characterized by the peculiar free tone assumed generally by him and his contemporaries.

Rabeschi (*rāb-ēs'kē*). See *Arabesque*.

Rabi (*rā'bi*), ISIDOR ISAAC, nuclear physicist, born in Austria, July 29, 1898. After receiving his Ph.D. from Columbia Univ. (1927), he con-

tinued his studies in Europe. He joined the faculty of Columbia in 1929. Rabi received the 1944 Nobel Prize in physics for his research on the resonance method of registering the magnetic moments of atomic particles. A member of leading U.S. scientific advisory committees, he was appointed (1958) to head the U.S. delegation to the N.A.T.O. scientific committee.

Rabies (*rā'bēz*). See *Hydrophobia*.

Raccoon (*rāk-kōon'*), a carnivorous mammal, about the size of a large house cat, that can be readily recognized by its broad black facial mask and banded, long, bushy tail. Its sturdy appearance is due to a long coat of grayish-brown fur. The raccoon is strictly American, ranging from Canada to Paraguay. It is a night prowler and sleeps all day in a hollow tree or a crevice in the rocks. Its specific name *Procyon lotor* refers to the animal's peculiar habit of dunking or washing its food in water. Its favorite haunts are the woodlands and brush country, especially in the vicinity of water, where it uses its long, sensitive fingers to catch crayfish, mussels, frogs, and salamanders; it also feeds on birds' eggs, mice, insects, many kinds of berries, seeds, greens, and ripening sweet corn. Mating takes place in March or April; nine weeks later, two to six fully clothed young arrive, marked exactly like their parents. Their eyes open in two or three weeks, but it is two months before the family follows the mother in single file through the woods. Raccoons reach maturity in one year and live for about ten years in all.



Courtesy N. Y. Zoological Society

EASTERN RACCOON

Race (*rās*), a competitive contest of speed, including such modes of movement as running, skating, riding, driving, rowing, motoring, flying, and sailing. Racing may be a contest between individuals, as in walking and swimming; a test of machines, as in bicycle and automobile racing; or a test of speed in animals, as in driving and running horses, and greyhounds or whippets.

Sports and exhibitions of this class are very popular in Europe and America and are prominent as distinct competitive tests, or as features in fairs and exhibitions. Running foot races are usually confined to spaces ranging from 60 to 100 yards, but more recently they have been extended to include contests that cover distances of 25 m. or more. Yacht races and rowing contests have assumed international proportions, such as those held at various periods between representatives of Great Britain and the U.S.

Horse racing, called the "sport of kings," and dating back to Roman chariot races is one of the most popular sports and has been greatly developed by careful breeding and training of several species of the horse. These contests are concerned in obtaining the highest possible speed for comparatively short distances. Races are divided into those provided for runners, trotters, or pacers. Horses are entered for racing contests according to the class in which their record as to speed entitles them to run. The running record takes precedence of all others, since horses excel in running rather than in pacing or trotting. A mile is usually taken as the standard and the contest is on a circle of that distance. The running record of a mile in 1 minute and 34½ seconds is high as are a pacing record of 1 minute and 55 seconds and a trotting record of 1 minute and 55¼ seconds. Laws against gambling at race tracks through bookmakers have been passed by a number of states. Bets at race tracks through the pari-mutuel system are permitted, however.

Famous traditional races include the Irish Sweepstakes, the Calcutta Sweepstakes (in the famous English Derby), the Grand Prix de Paris (at Longchamps, Bois de Boulogne), the Kentucky Derby, and some others.

Races of the World (*rās'ez, wūrl'd*). See *Ethnology; Man*.

Rachel (*rā'chēl*). See *Jacob*.

Rachel (*rā-shēl'*), ELIZA, stage name of Elisa Félix, tragic actress, born at Mumpf, Switzerland, Mar. 24, 1821; died in Cannes, France, Jan. 3, 1858. She was of Jewish ancestry, but is usually classed as a French actress. Her father's name was Jacob Félix and her true name was Elizabeth Félix, Eliza Rachel being her stage name. Both her parents traveled on foot through France as peddlers, and she joined a troupe of Italian children at Rheims to earn her living as a singer in the cafes and on the streets. Her parents settled at Paris in 1830, where she received instruction from a teacher of singing who had been impressed with her talent, and in 1832 she was received in the Conservatoire. In 1837 she made her first appearance on the stage at the Gymnase at Paris, but attracted little attention until the following year, when she appeared in the classic productions of Racine and Corneille at the Théâtre Français.

Her favorite roles included *Camille* in "Les Horaces," *Emilie* in "Cinna," *Hermione* in "Andromaque," and *Monime* in "Mithridate," but she also played successfully in the modern characters of *Judith* and *Cleopatra*. She made a tour of Europe in 1849, visiting Berlin, St. Petersburg, Vienna, and London, and was everywhere much admired. In 1855 she made a tour of the U.S., but returned to Europe afflicted with consumption.

Rachmaninoff (*răk-mă'nē-nōf*), SERGEI WASILIEVITCH, composer, pianist, and conductor, born in Novgorod, Russia, Apr. 2, 1873; died in 1943. Rachmaninoff studied music at the St. Petersburg



Courtesy RCA

SERGEI RACHMANINOFF

and Moscow conservatories and at the age of 20 was appointed professor of piano at the Marinsky Inst. for Girls in Moscow. He appeared as conductor of a private opera (1897-98) and of the Imperial Theater in Moscow (1904-06). He made his debut as a pianist in London in 1899, and 10 years later repeated his European successes with a triumphal tour of the U.S. He moved to this country in 1918. Conceded to be one of the most brilliant pianists in concert history, he is also the composer of three one-act operas, piano concertos, symphonies, choruses, songs, and other instrumental and vocal music.

Racine (*ră-sēn'*), county seat of Racine County, Wisconsin, on Lake Michigan, at the mouth of the Root River, 62 m. N. of Chicago, Ill. It is on the Chicago & North Western and the Chicago, Milwaukee, St. Paul & Pacific R.R.'s. There is an excellent harbor on the lake, which can receive the largest vessels. The site is about 40 ft. above the lake. It has a large trade in lumber, grain, and merchandise. The manufactures include furniture, automobile accessories, steam engines, lumber products, linseed oil, woolen

goods, rubber clothing, machinery, malted milk, printing, and farming implements. Among the noteworthy buildings are the county courthouse, the city hall, the Federal building, and many fine churches. It is the seat of Racine Coll., St. Catherine's Acad., St. Luke's Hospital, Taylor Orphan Asylum, St. Mary's Hospital, Lincoln Hospital, and a branch of the extension division of the Univ. of Wisconsin. The first settlement on its site was made in 1834. It was incorporated as a village in 1843 and as a city in 1848. Population, 1940, 67,195; in 1950, 71,193.

Racine, JEAN BAPTISTE, dramatic poet, born at La Ferté-Milon, France, Dec. 21, 1639; died in Paris, Apr. 12, 1699. Both his parents died while he was still young and he was raised by his maternal grandmother, who sent him to the Coll. of Beauvais at an early age. His grandfather died when he was 16, and he was sent to Port Royal to live with other relatives, where he studied advanced branches and languages. His educational study was finished at the Coll. d'Har-court, where he met distinguished scholars and formed a devotion for a life of letters.

The first tragedy of Racine was acted at the Palais Royal Theater by Molière's company, in 1664, and in the following year his "Alexandre," was presented on the stage. This production placed him before the public as a rival of Corneille and he was granted a pension of 600 livres by the king for a congratulatory ode. From this time

TITLE PAGE OF THE WORKS OF JEAN RACINE

ŒUVRES DE JEAN RACINE.

TOME PREMIER.

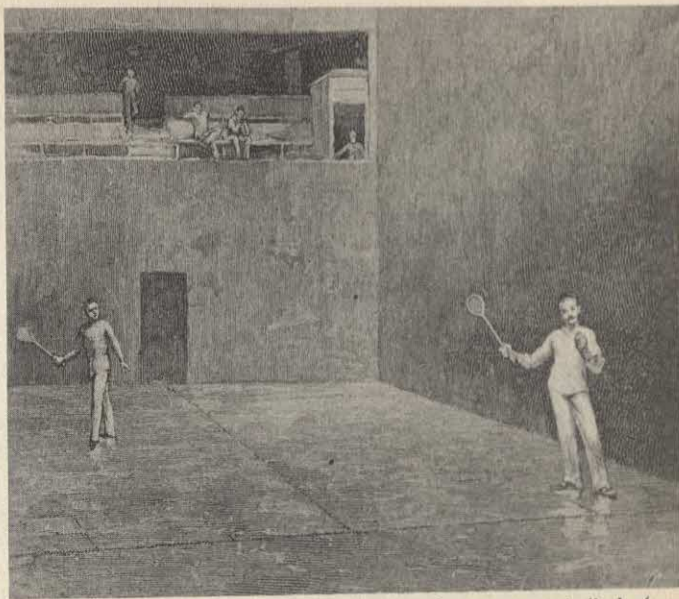
IMPRIME PAR ORDRE DU ROI
POUR L'ÉDUCATION
DE MONSIEUR LE DAUPHIN.



A PARIS,
DE L'IMPRIMERIE DE FRANÇOIS AMBR. DIDOT L'AÎNÉ.
M. DCC. LXXXIII.

THE GAME OF RACKETS

This 1893 engraving shows the court at the Racquet Club in New York City, a fashionable rendezvous for wealthy sportsmen (courtesy The Bettmann Archive)



on, his plays set the pattern for European tragedy. Based largely on Greek and Latin models, they are strictly "classical" in their adherence to the unities of time, place, and action, but they also display a profound knowledge of psychology. In them, Racine perfected the poetry of French tragic drama. The most notable were "Andromaque" (1667), "Phèdre" (1677), "Esther" (1689), and "Athalie" (1691). Among other court positions, Racine held that of historiographer (shared with Boileau) during the Flemish campaigns of Louis XIV.

Racism (*rās'iz'm*). See *Man*.

Rackets (*rāk'ets*), a game played by two to four persons, with a ball and rackets, on a four-walled court (60 ft. by 30 ft.). Three of the walls are 30 ft. high, and the back wall is 15 ft. high. The game is believed to have originated in England in the 18th century in a debtors' prison. It was soon adopted by the wealthy classes and brought to Canada. Eventually, in the 19th century, it reached the U.S.

It is played with a ball (1 in. in diameter) made of strips of tightly wound cloth bound with twine and covered with kid. The hardness and speed of this ball make rackets one of the fastest and most dangerous of indoor sports. The rules of the game are similar to squash rackets (*q.v.*), a more popular offshoot of the original English game, played with a softer ball that makes a "squashy" sound.

In the late 1800's, rackets was a fashionable recreational pursuit, especially along the Eastern seaboard. But now it is rarely played outside of New York, Boston, and Philadelphia.

Rackham (*rāk'gm*), ARTHUR, artist, illustrator, born in London, England, Sept. 19, 1867; died in Surrey, Sept. 6, 1939. Rackham was noted

for his drawings for humorous periodicals (e.g., *Punch*) and for his imaginative book illustrations. Among the books he illustrated were editions of "Rip Van Winkle" (1905), "Alice in Wonderland" (1907), Andersen's and Grimm's fairy tales, Milton's "Comus" (1921), "The Tempest" by Shakespeare (1926), and "Peer Gynt" (1936). Some of his drawings are in the collections of major European galleries.

Racon (*rā'kōn*). See *Radar*.

Radar (*rā'dār*), apparatus by which radio waves are used for detecting and locating distant or invisible objects. The word is coined from RADio Detection And Ranging. Though its basic idea antedates World War II by many years, it was not until this war that radar reached the stage of practical application. Heinrich Hertz, discoverer of radio waves, demonstrated in 1886 that these were reflected by solid objects. Radar utilizes this discovery by producing and sending out radio waves, and receiving the reflected waves which strike an object, such as an airplane or ship. The interval between the time the signal is sent out and the time of its return indicates the distance of the obstacle from the radar transmitter. Returning radio waves are frequently referred to as the "radar echo," since the principle of reflected radio waves is similar to that of reflected sound waves which return as an echo when, for example, they strike a cliff. The speed of all electromagnetic waves, which include radio waves, infrared rays, visible light rays, or ultraviolet rays, is 186,000 m. per second or 3×10^8 meters per second. The time required for a radio wave to travel from the radar transmitter to an object 1 m. away and to return to the receiver is 10.8 microseconds. (A microsecond is one-millionth of a second.) The number of miles

from the radar transmitter to the reflecting object can be calculated by dividing the total number of microseconds required to send out and receive the reflected echo by 10.8. Such delicate timing and calculating is done by electronic clocks and a calibrated indicator.

Radar apparatus comprises a transmitter which emits the radio waves; a modulator which governs the number and duration of pulses of radio waves per second to be transmitted; an antenna assembly which beams or aims the radio waves at the target, and which also picks up the returning echoes; a receiver which takes and amplifies these faint echoes, thus converting them into the form in which they are to be registered; and an indicator which registers the echoes visually on a scale.

The idea that radio reflections could be used to locate ships, planes, and other objects, occurred to scientists in England, France, Germany, and the U.S. A German patent was issued in 1904 on the use of radio waves as a navigational aid to reveal obstacles in the path of ships. As early as 1899, Tesla understood the significance of reflected echoes of magnetic waves. Marconi in 1922 suggested the location of objects by wave reflection. In 1922, two scientists working at the U.S. Naval Aircraft Radio Laboratory suggested that radio waves could reveal enemy ships in time of war. In the 1920's, the U.S. Signal Corps experimented with a radio detection set. In 1925, scientists at the Carnegie Institution were measuring the height of the ionosphere (an ionized layer in the upper atmosphere), which reflects long-wave radio waves, by timing the return echoes. The Naval Research Laboratory in 1930 reported that overhead planes reflected radio signals, and by 1933, it had developed a radar antenna which both broadcast and received radio signals. The British, in the meantime, had developed a practical radar detection apparatus, and in 1935 set up five radar stations on England's east coast. This was the first radar system ever installed. Fifteen additional stations were added in the next two years. By 1940, the U.S. had installed radar sets on the battleships *New York*, *Texas*, *California*, the aircraft carrier *Yorktown*, and on various cruisers. This same year the Army adopted a ground radar set, and it was one of these that first detected the Japanese planes approaching Pearl Harbor (Dec. 7, 1941). The first British radar sets operated on wave lengths of 50 meters, and the radar apparatus issued to the services prior to 1942 operated on long wave lengths down to wave lengths of 1 meter, corresponding to 300 megacycles. (The frequency in cycles of an electromagnetic wave increases as its wave length decreases. A megacycle is the equivalent of one million cycles.)

Scientific experiments showed that radio waves

of shorter length and higher frequencies give better resolution (accuracy) to radar. Resolution in range is the ability of the returning echoes to distinguish between two targets in the same direction (bearing) at slightly different ranges: for example, one target somewhat closer than the other but in the same line of sight. Range resolution depends upon the pulse length and is independent of operating wave length. Resolution in bearing is the ability of the returning echoes to distinguish between two targets which are at the same range but close to each other, such as two targets almost side by side at the same distance. Angular resolution does depend on wave length, in that an antenna of given size produces a sharper beam at shorter wave lengths, permitting better angular resolution. In 1940 the Radiation Laboratory of Massachusetts Inst. of Technology, in cooperation with British scientists, began research on the practical application of microwaves 10 cm. or less in length to radar. Wave lengths of 3 cm. or less were found to give even better results than those of 10 cm. in length. The British in 1940 revealed a special magnetron tube, which was the first radio tube which could produce sufficient power to make radio waves of 50 cm. or less feasible in radar detection. The use of the magnetron made it possible to direct powerful, narrow, focused, high-frequency waves in beams at the target. The microwaves are produced in the magnetron tube of the transmitter, from which they are carried by waveguides (round or rectangular pipes which conduct the waves by internal reflection) to the antenna. There parabolic reflectors or mirrors give the effect of strengthening the power of the beam.

Since the radar sends out short pulses of signals, to obtain accurate range information, the same antenna can be used to send out signals and to receive the returning echoes. A device known as the modulator governs the period of sending and receiving. It releases the radio pulses to the antenna for a period of microseconds. It then cuts off the transmitter for a longer period of time to await the echoes. The echoes are picked up by the antenna, pass through the waveguide, go into the receiver which amplifies and converts them, and then are registered on the indicator.

In the simplest form of radar indicator or screen, a spot of light starts on one side, at the moment the transmitter is turned on, and moves across the screen. The instant an echo comes in, the spot bounces upward making a "pip." The distance of the pip from the starting point of the spot of light indicates the amount of time required for the radio wave to be sent out and reflected back, and therefore, the distance of the target from the transmitter. A scale calibrated in distance units across the screen shows this distance at a glance. The most useful radar screen



AIRCRAFT CARRIER RADAR

Radar-radio antenna installation on top of aircraft carrier *U.S.S. Lexington*. 1, 2, 3 Radio communications; 4 Fire-control radar (aims guns at targets); 5, 6, 7, 8, 9 Radio communications; 10 Air-search and height-finder radar; 11 Radio communications; 12 Radar test equipment; 13 Surface-search radar; 14 Radio communications; 15 Homing beacon (radio); 16, 17, 18, 19, 20 Radio communications; 21 Air-search radar; 22 Radio homing beacon; 23 Air-search radar; 24, 25 Radio communications; 26 Identification radar; 27, 28 Radio communications

is the PPI (plan position indicator), the face of a cathode-ray tube (similar to that used in television), which reproduces a map of the area covered by the rotating antenna system. The center of the screen represents the location of the radar apparatus. The beam of the cathode ray tube is swept from the center to the edge of the tube once for each transmitted pulse, and these sweeps, or scans, are synchronized with the rotation of the radar antenna. Echoes increase the brightness of the trace, so that the returning echoes trace out a luminous map of the area being scanned. The degree of brightness of the luminous picture depends on the ability of the target to reflect radio waves. Water remains dark on the screen, because the surface functions like a mirror and does not return the incident beam in the direction of the transmitter. Land shows more brightly, while metal objects reflect the waves best of all and are brilliant. Thus planes, ships, and cities are easily visible on the screen, which is painted with a fluorescent material so that it continues to glow for a short interval after the sweep-hand has passed over it, thus giving a full map of the area. During the war, PPI was incorporated into all classes of radar apparatus, ground, airborne, and ship. In airborne radars, since radio waves pass through fog, clouds, or darkness, PPI gives a complete picture of the areas beneath the plane and serves as a bombing aid when visibility is lacking. On ship radars, PPI was improved by superimposing an actual chart

of the area on the cathode-ray screen. With the superimposed chart, it was called the Virtual PPI Reflectoscope.

The first U.S. microwave equipment issued was the radar ground set, SCR-582, made for the Signal Corps in 1942. These were sent to the Panama Canal to supplement the longer-wave sets there, and they were also used in the invasion of North Africa. In that same year, SCR-584, a versatile ground radar, was adopted by the Army. It surpassed the German Würzburg radar in its ability to locate planes, and was invaluable to anti-aircraft personnel. In 1943 the airborne radar "Mickey" was introduced as a blind-bombing aid. It was a 3-cm. version of the earlier 10-cm. H2X airborne radar. On Nov. 3, 1943, it was first used when nine B-17 Pathfinder planes led a combat force of 60 bombers which dropped bombs accurately on the waterfront area of Wilhelmshaven, Germany, though the area was blanketed by heavy overcast. The largest and most powerful ground radar developed was the Microwave Early Warning set, MEW. It proved its value on D-Day when it provided information needed to dispatch fighters and bombers, and to direct air operations over the English Channel.

Racon is the name of any radar beacon system. The racon system consists of a receiver-transmitter combination, which sends out a return signal when it receives an activating signal of the same code from a radar device. Thus, two units are required, for example, one airborne and the

other on the ground. It provides navigational aid or identification at longer distances than radar, because radar depends on one signal sent out and reflected back. The echo loses in strength as the distance between the transmitter and the target increases. With racon, when a signal is sent out, it triggers or sets off a device which sends back a new signal. The new signal is stronger than an echo and thus can be used over greater distances. Early in the war, a racon device called Identification Friend or Foe (IFF), was used as a means of identifying friendly planes. The racon apparatus in the plane was set to respond in the code of the day to an interrogation signal from a ground device. The apparatus was wholly automatic, and the plane's crew was not in control of it. Any plane which did not respond to the signal from the ground station, or which did not reply with the proper code signal, was considered an enemy plane.

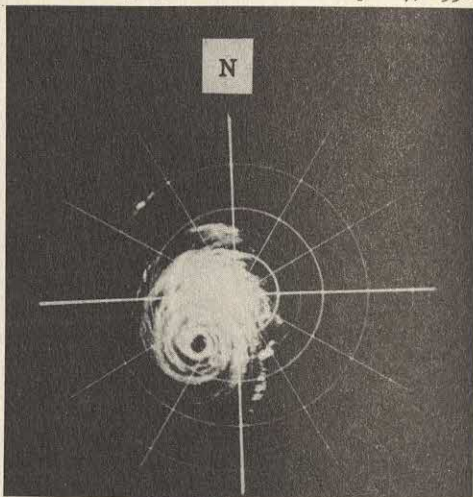
Loran (*q.v.*) was a navigational system which sent out radio signals to ships. It was not a radar system, for its effectiveness did not depend on returning echoes. Its greatest advantage was that ships did not reveal their position to the enemy while using it, and could maintain radio silence to avoid detection. See also *Shoran*.

Radar altimeters indicate the height of a plane from the ground by sending out high-frequency waves. The echoes reflected from the ground register on a scale to indicate the plane's altitude.

During World War II, radar operators observed that precipitation presented echoes on the radar scopes used for tracking aircraft, but the matter was not intensively exploited until the end of the war. Following the conflict, the U.S. Navy Electronic Laboratory began studies on the value of radar in obtaining data for weather forecasting. In 1945 the U.S. Army tracked a September hurricane using radar designed for military use. And, in 1947, the U.S. Weather Bureau began the installation of modified war-surplus radars at Weather Bureau offices for surveillance of storms within radar range. The average range of these radars is about 150 nautical miles (n. m.), with two more powerful coastal radars having a range of 200 n. m. The more powerful radars are located at Nantucket, R.I., and Cape Hatteras, N.C. Radar provides the following information about a hurricane: (1) Location of "eye" or center; (2) size and configuration of "eye"; (3) direction of past movement of "eye"; (4) speed of "eye"; and (5) areal extent of precipitation echoes.

It was the radar located at Cape Hatteras that tracked hurricanes "Connie" and "Ione" in 1955. In 1958 Cape Hatteras radar tracked continuously the hurricanes "Daisy" and "Helene" for periods of 12 hr. as the hurricanes moved north-

ward off the coast of the Carolinas. The accompanying photograph shows the type of presentation the radar gives of a hurricane. The example is hurricane "Helene" when its center or "eye" was located 72 n. m. to the southwest of Cape Hatteras at 5:05 P.M. E.S.T. on Sept. 27, 1958.



HURRICANE "HELENE," 1958

Such radar "portraits" of hurricanes are of inestimable value to weather forecasters in alerting populations in the indicated path of the storm

Water droplets of sufficient size to reflect radar signals are the white presentation on the black background of the radar's scope, called a Plan Position Indicator (PPI) scope.

Specially developed radar apparatus for patrol planes is used to serve ships passing through the iceberg areas in the North Atlantic. The dangerous season is from March to July. During times of low visibility, the patrol planes locate these bergs and report them. Ship radars are able to locate the larger icebergs easily, but small bergs washed by high waves are more difficult to detect, except from the air.

Wartime marine radar had to be redesigned for peacetime use. The high-powered military radars were effective over ranges from one to more than 100 m., but ordinary shipping must locate obstacles at short ranges, even to feet, to avoid collisions, or to navigate crowded harbors during low visibility. One model of shipping radar was developed, called the "electronic navigator." It consists of an antenna housed in a "radome": a console containing the transmitter, the receiver, and the cathode-ray-tube indicator, plus the necessary power supply and controls. The radar pulses are less than one microsecond in length and are repeated at the rate of 1,000 times per second. The indicator is a 7-in. cathode-ray tube, which duplicates an area 4 m. in diam-

eter, or, when adjusted, even greater distances.

Ground radar systems were adapted to the landing of civilian airplanes in bad weather. The first Ground Controlled Approach (GCA) system was introduced during the war (Nov. 1944). As demonstrated for civilian use by the Navy in Florida (1946), it consisted of two complete ground radar sets, six radio transmitters, and six receivers, all mounted on a truck. The plane's pilot had ordinary radio transmitters and receivers. Since the ground crew was continuously following the plane's position in the indicator, they were able to send exact directions for the plane's movements to the pilot by radio. To make the blind landing, he followed directions and instructions with extreme exactitude.

On Jan. 10, 1946, the U.S. Signal Corps announced that radar signals had been sent from Belmar, N.J., to the moon, and that the returning echoes had been recorded on a cathode-ray tube. This was not the first time that radar signals had been sent to the moon. They had been reported earlier by Sir Robert Watson-Watt, outstanding British contributor to the radar field, but this was the first official experiment in the U.S. The radar set used for the moon experiment used a double-sized antenna and a receiver 60 times as sensitive as the usual receiver. Radio pulses were sent out in blasts of one-half second duration, instead of the usual 20 microseconds duration, and an interval of 4 or 5 seconds was left after each transmission to await the echo return. Radio waves of 111.6 megacycles in frequency were sent out. The moon is not a stationary target. The earth is either traveling away from or toward the moon at the rate of 750 m.p.h. It is moving toward the moon at moonrise. The round-trip distance from the earth to the moon is about 477,714 m. The radar signals made the journey to the moon and back in $2\frac{1}{2}$ seconds. The success of this test seems to imply that radar could track rockets which might be projected beyond the atmosphere of the earth.

Radar adapted to civilian planes enables the pilot to see on the radar screen the terrain beneath him, though it is obscured by clouds, fog, or snow. Similarly, ground sets enable the personnel of landing fields to guide in a plane where visibility is lacking. Loran, Shoran, and Racon are useful navigation aids.

Radcliffe (*răd'klif*), ANN WARD, novelist, born in London, England, July 9, 1764; died there, Feb. 7, 1823. Her stories, especially the later ones, are tales of mystery and horror, set against a romantic background of English ruins, and are characterized by apparently supernatural occurrences, which later turn out to have a perfectly natural explanation. Her most famous works are "The Romance of the Forest" (1791), "The Mysteries of Udolpho" (1794), and "The Italian"

(1797). Mrs. Radcliffe's novels are thought by critics to have had a strong influence on Sir Walter Scott's narrative technique, and the hero of "The Italian" is seen as the prototype of the "Byronic hero."

Radcliffe College, a nonsectarian institution of higher learning for women, in Cambridge, Mass., affiliated but not corporately connected with Harvard Univ. In 1879 a group of Harvard professors, led by Arthur Gilman, inaugurated courses of instruction for women. In 1882 this group was chartered as the Society for the Collegiate Instruction of Women (called the Harvard Annex), and in 1894 it was rechartered and named Radcliffe Coll., in honor of Ann Radcliffe, who endowed the first Harvard scholarship. Instruction of undergraduate and graduate students is given by members of the Harvard faculty, and the college operates under the same tutorial system as Harvard. The annual enrollment is about 1,400 students.

Radek (*ră'dek*), KARL BERNARDOVICH, politician, born at Lemberg (Lwów), Poland, in 1885. Radek joined the Social-Democratic party of Poland and Lithuania at the age of 19 and spent the year 1905 in prison as a dangerous radical. He then became a writer for Social-Democratic newspapers in Poland and Germany (1906-14) and after the revolution (1917) in Russia allied himself with Lenin. In 1918 he participated in reorganizing the Communist party in Germany, where he was again imprisoned (1919). Returning to Russia, he attained considerable importance in the Communist International but, suspected of being sympathetic to the cause of Leon Trotsky, was deprived of his party membership from 1927 to 1930, when he was readmitted. Although he was readmitted to the party and regained much of his former influence, he subsequently became involved in activities considered questionable by party leaders and, charged with treason, he was imprisoned (1937). In 1941, however, he was released to serve as a propagandist.

Radetzky (*ră-dets'kē*), JOSEPH WENCESLAUS, COUNT OF, soldier, born at Trebnitz, Bohemia, Nov. 2, 1766; died in Milan, Italy, Jan. 5, 1858. He joined the army at the age of 18 and served against the Turks in 1788-89. He took part in all the great battles of Austria, including those of Hohenlinden, Wagram, and Leipzig, and in 1814 accompanied the allied forces into Paris. In 1830 he was called to Italy to suppress the disturbances that followed the French revolution of that year. He was made a field marshal in 1836 and retired in 1857.

Radford (*răd'fôrd*), an independent city in Virginia, on New River, 43 m. w. of Roanoke. It is served by the Norfolk & Western R.R. Radford has railroad repair shops and manufactures lumber and iron products. It is the seat of Rad-

ford State Teachers Coll. and Radford Coll., the women's division of Virginia Polytechnic Inst. The city was incorporated in 1885. Population, 1940, 6,990; in 1950, 9,026.

Radford, ARTHUR WILLIAM, naval officer, born in Chicago, Ill., Feb. 27, 1896. He was graduated from the U.S. Naval Acad. (1916) and took flight training (1920), later serving with various naval air units. In World War II the greater part of his service was in the Pacific. In 1949 he was made an admiral and was appointed commander in chief of the Pacific Fleet. From 1953 to 1957 he served as chairman of the Joint Chiefs of Staff of the U.S. armed forces.

Radial Artery (*rād'i-əl ārt'ēr-ē*), in anatomy, the artery which lies on the radius bone of the forearm and on which the pulse can best be felt.

Radial Nerve (*nērv*), in anatomy, the nerve which lies on the radius bone of the forearm.

Radiata (*rā-dī-ā'tā*), the name of the lowest of the four great divisions into which Cuvier classified the animal kingdom. It includes those forms in which the parts radiate from a central axis. These parts include both the organs of sense and those of motion. This classification went out of use in the latter part of the 19th century, when the animals included in it were divided into Protozoa and Coelenterata.

Radiator (*rā'dī-ā-tēr*), a heating unit exposed to view within the room or space to be heated. A radiator transfers heat by radiation to objects within visible range and by convection to the surrounding air which, in turn, is circulated by natural convection. (A so-called radiator is also a convector, but the term radiator has been established by long usage.)

The usual radiator consists of cast-iron shapes of varying width and height, made up in units which are assembled in varying lengths to suit the space requirements. Radiators are usually heated by steam or hot water. With the steam system, a boiler is provided, usually in the basement of the building to be heated. The boiler is connected to the radiators by means of pipes, and the condensed steam is returned to the boiler. Systems using water to carry the heat to the radiator differ only in that the entire system, including the boiler in the basement, radiators, and all pipes, is filled with water. The water is circulated either by gravity resulting from the influence of the heat or by means of circulating pumps, which pump the water through the system.

Radiator is also the name commonly used for the heat transfer unit used in automobiles and other internal-combustion engines to cool the engines.

Radio (*rā'dī-ō*), an electrical method of transmitting and receiving intelligence or power impulses between separated points by radiation phenomena without the mediation of wires. Radio

waves, bearing a message, are radiated into space, where they may be detected within the effective area of reception. The fundamental conception of radio originated with James Clerk Maxwell when he proved (1865) that light, heat, and electricity all consist of electromagnetic waves, differing only in *frequency* (i.e., the rate at which the direction of current is reversed). His work was forwarded by Heinrich Hertz, who succeeded in propagating electromagnetic waves in 1886.

Radio waves, like light and heat, are propagated through a hypothetical medium known as the *ether*, which pervades all space. Sound waves, on the other hand, travel only in gases, liquids, and solid materials.

Guglielmo Marconi made the first practical application of Maxwell's discovery in 1896 when he sent coded messages over a distance of 2 m. The essential element of his transmitter was that it generated electromagnetic waves, interrupted at characteristic intervals. The receiver, by responding to the generated waves, converted the interruptions into sounds—simple dots and dashes—similar to wire telegraphy.

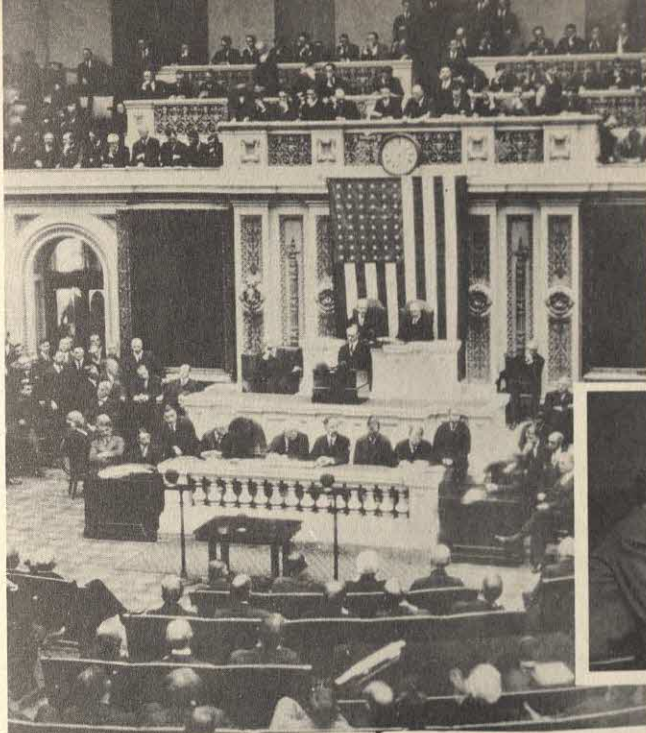
The fundamental principle of Marconi's first wireless transmitter has not changed to this day, but his other devices have been outmoded. He used a charged Leyden jar condenser, attached to a coil through which it discharged. The electrical *condenser* or *capacitor* (*q.v.*) is a device for storing an electrical charge. So long as the charge or current of electricity continues to flow in one direction (*direct current* or *D.C.*), it is unable to cross the air or other insulating material (dielectric) which separates the opposite poles of the condenser. When the current reverses or *alternates*, the electrical impulses fluctuate across the condenser. The rate of alternation is known as the *frequency*. A coil through which the condenser may be caused to discharge has an electromagnetic property known as *inductance*.

MARCONI AT AN EARLY RADIO STATION

With his first assistant, G. S. Kent (*right*)

Radio Corporation of America, Camden, N. J.

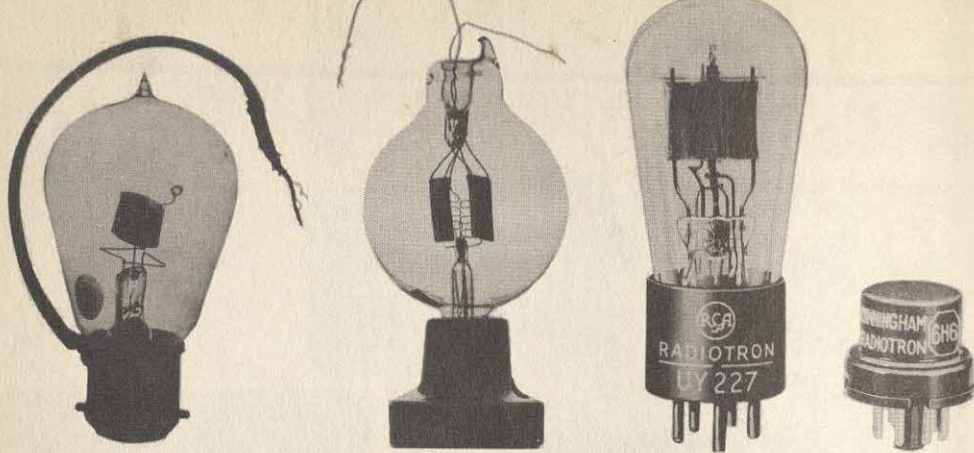




RADIO'S FAR-RANGING SERVICE

The role of radio in public affairs has grown enormously since Calvin Coolidge (*above*) broadcast the first Presidential message—to a joint session of Congress—on Dec. 6, 1923. It now encompasses programs such as "Radio Beat" (*above right*), in which prominent Americans discuss current issues with speakers in foreign countries. Shown here is Adlai E. Stevenson (*right, in photo*) participating in a program of this series (CBS Newsphoto). The modern broadcasting studio (*right*) is scientifically designed for optimum radio reception; behind the broadcaster is the glass-enclosed control room (*courtesy NBC Radio*). Ship-to-shore radio includes such emergency equipment as this (*below*) aboard the S.S. *America*, which operates when all other means fail (*courtesy Radio Corp. of America*). The wide use of automobile radio and audience participation is reflected in a Boston (Mass.) service, the "WHDH Request Wagon," which relays motorists' musical requests to the station





Courtesy Radio Corporation of America

EVOLUTION OF RADIO TUBE DESIGN

(left to right) Fleming valve, De Forest audion, first A-C tube, and all-metal tube sealed in steel

Depending upon its inductance, the coil, in combination with the condenser, has a characteristic frequency; the frequency of the transmitted signal is that at which the condenser and inductance are in equilibrium, or *resonance*. In modern radio transmitters, tuned circuits controlling the wave length still consist of condensers and inductance coils, but these only help to transmit into space the oscillations established by other means, chiefly through the use of quartz crystals and vacuum tubes.

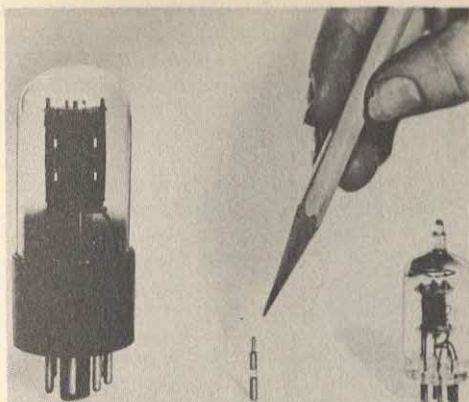
Until the discovery of the two-element vacuum tube by Prof. J.A. Fleming (1904) and its practical development into a three-element tube by Dr. Lee De Forest, radio communication was almost entirely telegraphic, *i.e.*, dot and dash code transmission. In 1906 De Forest demonstrated that sound waves could be imposed upon high-frequency radio or carrier waves by means of vacuum tubes, which respond instantaneously to changes in sound frequency. To distinguish it from wireless code transmission, known as *telegraphy*, the broadcasting of voice and similar sounds is designated *radio telephony*. Light, which also consists of waves of characteristic frequency, can be used to modulate a radio signal in such a way as to transmit a visual image which can be received on a properly constructed screen. The transmission and reproduction of still images, such as maps, photographs, printing, or writing, is known as *radio facsimile*; *television* is the name given to the transmission and reception of visual images while in motion.

The broadcast carrier wave of radio frequency is a sine wave of constant *amplitude* (*i.e.*, the average power radiated is constant), which can be varied or *modulated* by superimposing another wave of audible (audio) or picture (video) frequencies. The combined wave is then sent out through space where it creates an electrical charge of corresponding frequencies in the antenna of a

receiving set. The receiver then filters out (*detects* or *demodulates*) the high-frequency radio wave, and the result, by causing the diaphragm of the loudspeaker to vibrate, reaches the listener as music, voice, etc., or, by reacting upon a suitably constructed circuit, produces a television picture.

Electrical disturbances, such as lightning, are often heard by the listener in the form of static. To minimize such undesirable sounds, another form of radio transmission has been applied to broadcasting in relatively recent times. In this form, instead of modulating the amplitude of the carrier wave, the sounds which are to be broadcast are superimposed upon the radio wave by modulating the frequency. Frequency Modulation does not eliminate static, but it does make possible the use of an additional device, known as a *limiter*, which greatly reduces the static-bearing signals.

Marconi's first broadcast, which proved the feasibility of wireless communication, has been followed by rapid and consistent development of the industry. World War I revealed certain defects of existing systems and spurred inventors to renewed effort; meanwhile the vacuum tube and electronic detector, by opening the way for the broadcasting of voice and music, made possible the extension of radio into the average home. On Oct. 17, 1919, the Radio Corporation of America (RCA) was chartered with the prime purpose of building an American-owned international radio-telegraph communications system. Commercial overseas telegraphic communication was inaugurated the following year. The new industry progressed under such pioneers as Dr. Frank Conrad of Pittsburgh, who experimented with the use of short waves (high frequencies) for long-distance transmission, and whose station, KDKA, led the way in public broadcasting of such features as election returns, music, and sporting events. The first Presidential inauguration to be broadcast was that of Calvin Coolidge



MIDGET RADIO TUBE

The Air Force's new tube is 1/90 the size of a standard radio tube (left); it is also much smaller than the small-size electronic tube (right)

on March 4, 1925, over WEA and WJZ.

While the sale of radio receiving sets was sufficient to stimulate the industry in its early years, another source of development was demonstrated in 1922 with the first commercially sponsored broadcast. Commercial advertising over the air necessarily involved competition for the ear of the listening public, and led to increasingly ambitious programs. The cost of these programs necessitated their extension beyond the range of any single broadcasting station. This was accomplished through the medium of network broadcasts. Begun experimentally in 1923, they quickly proved their value; in 1926 the National Broadcasting Co., America's first commercial network, was established by RCA. A program originating in one station is transmitted directly to other members of the same network (usually by means of high-fidelity telephone wires) and broadcast by each of the network stations to its own local audience.

Direct radio-telephonic broadcasts over long distances have also been proved practical where wire connections are not available as, for example, most transoceanic communication. Short-wave signals (*i.e.*, high frequency, since wave length varies inversely with frequency) are generally superior for transmission over great distances because of atmospheric peculiarities. When frequencies, however, are increased into the ultra-high ranges, such as are required to obtain sufficient side-band widths for FM and television, a major part of the energy is dissipated beyond the atmosphere of the earth, and proper reception is possible only within the immediate area of transmission, known as the *line-of-sight*. Thus, some form of interconnecting network becomes increasingly important as the higher frequencies come into more common use.

Along with the greater tonal fidelity stimulated by the use of frequency modulation and

the use of the higher-frequency spectrum, goes another advantage of importance to the radio-listening public. Radio signals are transmitted by means of a fixed *carrier frequency* assigned to every regularly licensed station. In addition to this carrier frequency, the amplitude-modulated broadcast occupies in the ether channel a *side-band frequency* of 10,000 to 20,000 *cycles* (10 to 20 *kilocycles* or *kc.*) upon which the audible signal is impressed. For purposes of standard AM broadcasting, however, the range of available frequencies is limited, roughly, between 550 *kc.* and 1,600 *kc.* That is, the total broadcasting band covers only about 1,000,000 *cycles* (1 *megacycle* or *mc.*). Without some sort of authoritative agreement, competitive broadcasters might operate on the same or similar wave lengths, so that listeners would hear two or more programs simultaneously. To avoid this condition, all governments have adopted the right to control radio channels. In the U.S. the Dept. of Commerce first assumed jurisdiction in the early days of the industry; the Federal Radio Commission (later the Federal Communications Commission) was established in 1927 with power to license stations, fix wave lengths, hours of broadcast, etc. Numerous international agreements have been made on the subject, most noteworthy being the North American Regional Broadcasting agreement of 1940 under which Canada, Mexico, Cuba, and the U.S. reallocated operating wave lengths of hundreds of stations to eliminate interference. This and other agreements serve as an international pattern for standardizing radio operations for the most economical and practical use of the limited radio spectrum.

The advent of higher carrier frequencies offers some promise of eliminating overlapping. In addition, line-of-sight transmission narrows the area within which stations may compete. Thus, two FM stations may usually operate on identical frequencies at distances of about 200 m. from each other without noticeable interference, while AM stations would have to be separated by a much greater distance to obtain equal results during daylight hours, and by many times that distance during the night when changes in atmospheric conditions increase the area of radiation. It is for this reason that many stations are obliged to "sign-off" in the early evening while others continue through the night.

To transmit a radio signal, a broadcasting station generates the desired waves, and radiates these into space by means of an antenna or aerial. Greatest efficiency of operation demands that the length of the antenna be a definite fraction of the length of the radio wave. At the receiving end, the direction and length of the antenna affect the strength with which the signal

RADIO

producing new tubes and a host of new applications. Authorities have estimated that the stepped-up pace of electronic research in the five years of war accelerated the progress of television by 15 years.

The urgency of war centered attention on new weapons, improved communications, and methods for the more effective control of air traffic. Radar—radio detection and ranging—is a development typical of those that were greatly advanced by hostilities. Enemy and Allies alike used the system extensively and both sides introduced counter-measures, but it was generally agreed that the U.S. and Great Britain had carried refinements and effectiveness to a far higher degree than the German scientists. This was due to a considerable extent to the development of microwave tubes and equipment.

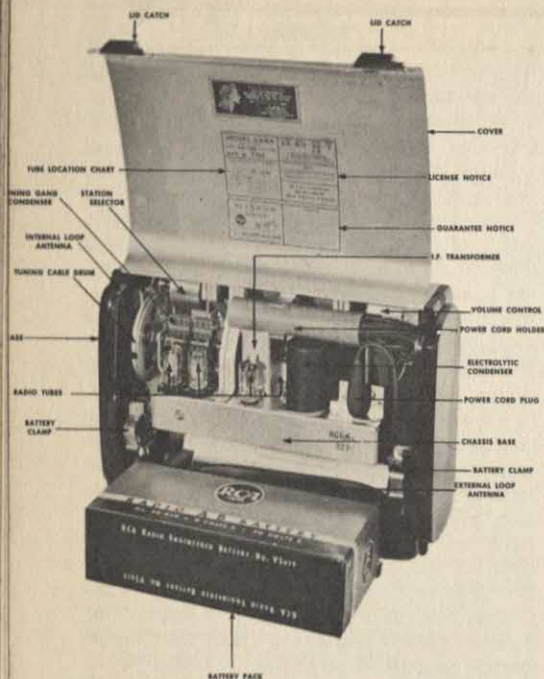
Other devices which passed through the war years under a cloak of secrecy were loran and shoran (*qq.v.*). Loran—a long-range navigational aid—made it possible for planes and ships to determine their positions at any time of the day and under the worst weather conditions with an accuracy far exceeding that possible by the usual sextant.

Shoran—connoting “short-range navigation”—proved to be the most accurate bombing device developed during the war. Bombing squadrons equipped with shoran proceeded with pinpoint accuracy to destroy bridges and enemy fortifications even when the targets were completely obscured. In peacetime, shoran has shown great promise as a highly accurate plotting and surveying instrument, of particular value in determining the exact position of off-shore oil drilling sites and in the precise mapping of topographical contours.

In the electron tube field, advances ranged from a diminution in size to a tremendous increase in power output, both extremes playing important roles in war and to an even greater degree in a great many peacetime applications.

American engineers and scientists succeeded in reducing the physical dimensions of tubes to a point where a complete five-tube transmitter and receiver could be enclosed in the head of a shell. Out of this advance came the proximity fuze (see *Missile*). These same miniature tubes are expected to result in smaller radio receivers and radio phonographs, and in a further dwarfing of hearing aids.

Hundreds of larger tubes were designed and produced for the military services, but the magnetron, an original British conception, is generally considered to have been the outstanding tube invention of the war. Previous to the introduction of the magnetron, the generation of high power at high frequencies had been one of the principal obstacles in the develop-



INTERIOR VIEW OF A PORTABLE RADIO

is received. Some electrical interference is always received with the desired signal, but by increasing signal strength, the antenna also increases the signal-to-noise ratio upon which proper reception depends.

Since the time of Marconi, progress in radio has been dependent to a remarkable extent upon the ability of science to explore the higher ranges of the frequency spectrum. Marconi's experiments, lacking the aid of the science of electronics (then in its infancy), were conducted only within the reaches of long-wave transmission. Continued research, however, has produced electronic oscillators with frequencies up to several billion cycles per second. It is within this vast area that the future of radio lies, for if the entire radio spectrum could be fully opened to the uses of man, there might well be sufficient space to allow each individual his own personal wave length. The upper frequencies, moreover, have been found to be relatively freer from electrical interference, which partly accounts for the more appealing quality of frequency modulation.

While World War I provided the impetus which launched the radio broadcasting industry in America, World War II had an even greater effect through the stimulation of technological progress. When the manufacture of all domestic radio apparatus was stopped in April 1941, the skill and manpower which radio had created in the preceding quarter-century swung into the development of radio devices for military use,

ment of an efficient radar system. Not only did the magnetron operate on the ultra-high frequencies but its design permitted the generation of thousands of watts of power in brief pulses.

Many forms of guided missiles, pilotless planes and robot ships depended for their effectiveness on television principles. Television made it possible to conduct dangerous experiments and observe critical processes by remote control, e.g., in the fabrication of the atomic bomb. Similar systems, revised for peacetime uses, are expected to be adopted by industrial plants to maintain a constant watch on delicate operations that could not be observed safely by the human eye. For the many devices discussed here, see also individual articles. See also color plate, *Means of Communication II*, in Volume II.

Radioactivity (*rā'di-ō-āk-tiv'i-tē*), radiation resulting from rearrangements of the particles within the nucleus of an atom (*q.v.*). Natural radioactivity was discovered by A.H. Becquerel (*q.v.*) in 1896, who found that uranium and its salts would blacken photographic plates and also make silhouettes on them of objects, such as those of lead, relatively impervious to X-rays. These new rays were at first called Becquerel rays. Marie Curie (*q.v.*) then isolated from a uranium ore (pitchblende) two new radioactive elements, polonium and radium. Later studies of Becquerel rays in electric and magnetic fields revealed that they are not undulatory disturbances like light or X-rays but have three components, two of which are electrically charged particles traveling at high speeds—(1) α -particles (*alpha*-particles) with positive charge and identical with helium-ions; (2) β -particles (*beta*-particles), formerly called cathode rays, now identified as negative electrons. The third component carries no charge, but is a form of electromagnetic radiation or γ -rays (*gamma* rays), similar to X-rays, but of shorter wave-length and greater energy. The radioactivity from the natural radioactive elements—uranium, thorium, polonium, radium, and actinium—results from a condition of unbalanced mass and charge within the atomic nucleus, which seeks to stabilize itself. Radioactive change also releases heat and radioactive gases.

The particles ejected from natural radioactive elements follow a definite displacement law, producing chains or families of radio-isotopes until finally a stable, non-radiating isotope (*q.v.*) is reached; e.g., radium and thorium descend to two different isotopes of lead. This process, sometimes called "decay" or "disintegration," is properly called intra-nuclear rearrangement, and the resulting chains are called a radioactive series rather than "decay-chains." The time required for a nuclear change to result in an isotope is a physi-

cal constant for each radio-isotope; but the physical constant generally used to identify radioactive species is the half-life, i.e., the time required for a radio-isotope to lose half of its activity. In 1934, Irène and Frédéric Joliot-Curie (*q.v.*) produced artificial radioactivity by bombarding nuclei with alpha-particles. An unusually penetrating radiation, the neutron (*q.v.*), was then discovered and made available for bombardment, since it was known that by bombarding stable nuclei with high-energy particles, the nuclei would be transformed by losing some of their own particles, resulting in the formation of another element; thus the transmutation of elements was achieved.

More sensitive apparatuses were then created to measure radiation (e.g., the Geiger counter), and accelerators (*q.v.*) were developed so that high-energy particles could be produced. By suitable selection of target materials, radio-isotopes of most of the elements in the periodic table can be produced in quantity by use of the uranium pile or nuclear reactor. Thus radioactivity and its techniques have led to the discoveries of the particle structure of atomic nuclei, the transmutation of elements, the production of new elements, and the production of nuclear energy in practical quantities. See also *Accelerators*; *Atom*; *Isotopes*; *Neutron*; *Nucleus*; *Physics*.

Radio Compass (*rā'di-ō kŭm'pas*), a radio receiver having a directional antenna and used for determining position and bearing of a ship. The U.S. Lighthouse Service maintains a number of radio beacons at strategic points on the Atlantic, Pacific, and Gulf coasts, and on the Great Lakes. These radio beacons emit characteristic signals which identify the beacon and make it possible for vessels at sea to determine position regardless of fog or darkness. In addition, a number of aircraft beacons operated by the Civil Aeronautics Authority transmit signals which may be used. By taking bearings on two such beacons, a ship's position is determined at the intersection of two lines on a map or chart drawn from the beacons in directions indicated by the radio compass.

The illustration shows a radio compass intended to be used in connection with the radio-telephone installation of a small yacht. A shielded loop antenna mounted upon the compass unit picks up signals from the shore beacons and converts these into audible signals which may be heard by means of headphones or loud-speaker. In order to determine the direction of a beacon the loop antenna is turned to position of minimum signal strength. When the dial of the antenna is properly adjusted, the reading of the dial gives the bearing of the beacon in degrees with respect to the ship's keel. The true bearing of the beacon may then be determined



Courtesy Bell Telephone Laboratories, N. Y.

RADIO COMPASS

A radio compass, designed to operate in conjunction with the receiving set of a marine radio telephone, enables yachts and other small craft to determine bearings and position at sea. It operates on a frequency range from 230 to 350 kilocycles and is used to pick up signals from marine radio beacons maintained by the U.S. Lighthouse Service. The shielded loop antenna for picking up the signals is mounted on top of the instrument. Tuning and volume controls are on the front panel.

by the application of the ship's course as obtained from the magnetic compass. This radio-compass unit operates on storage batteries of 6 or 12 volts also used to operate the ship's radio-telephone. Volume and tuning controls for the radio compass unit are mounted upon the panel. The radio compass covers a range of frequencies from 230 to 350 kilocycles.

Radiograph (*rā'di-ō-grāf*), also known as *Roentgenogram*, *Laue pattern*, *skiagraph*, *radiogram*, or *scotograph*, a photograph made with X-rays. The *roentgenogram* takes its name from W.K. Roentgen (*q.v.*), discoverer of X-rays, and is of two types: the *exograph*, taken with X-rays, and the *gammagraph*, taken with gamma rays. A *Laue pattern* takes its name from Max von Laue (*q.v.*), and is a photograph of the pattern made by X-rays which are diffracted by being passed through a crystal. A *skiagraph* is any photograph made by X-rays. *Radiogram* is a variation of the word radiograph. A *scotograph* is a photograph of the human body taken by X-rays. Any of the above terms are interchange-

RADIOMETER

able, except *Laue pattern* and *scotograph*, which refer to specific types of X-ray photograph.

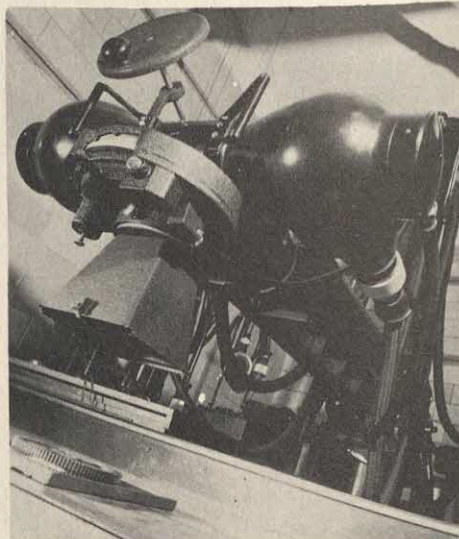
Radiological Warfare (*rā-dī-ō-lōj'i-kal war'jār*), a term for the potential use of radioactive materials in warfare to force military or civilian evacuation of cities or critical areas. See also *Atomic Energy*; *Germ Warfare*.

Radiometer (*rā-dī-ōm'ē-tēr*), an instrument which translates light into mechanical movement. Fundamentally it consists of four wings or vanes attached to a spindle, the whole mounted in a glass globe from which the air has been partially removed. One side of each vane is painted with lampblack so that it absorbs the light rays which fall on it. The opposite side of each vane is highly polished so that it reflects the light waves which fall on it. When the radiometer is exposed to light, the vanes rotate on the spindle. This motion is the result of light-absorption and light-reflection on the opposite sides of the vanes. The black side absorbs the light rays and so becomes heated. The polished side reflects the light and so remains cool. When the air molecules remaining in the partially evacuated globe touch the warmed surface of the vane, their velocity is increased and they rebound from this surface with greater energy than do the air molecules on the opposite side of the vane where it is cool. This stronger push of the air molecules rebounding from the black sides of the vanes causes rotation toward the polished sides of the vanes.

INDUSTRIAL RADIOGRAPHY

A standard 220 KW radiography unit, one of several types of equipment used for the investigation of X-ray properties

Courtesy Westinghouse Photo



The name *radiometer* also designates apparatus for measuring the radiation of electromagnetic waves. Such apparatus may include that similar to the bolometer (*q.v.*), or the thermocouple (*q.v.*) by which the heat radiation from stars can be measured; or apparatus incorporating the photoelectric cell for radiation measurements. In measuring X-ray radiations, the photoelectric cell is enclosed in a fluorescent-treated screen, which is in turn wrapped in a black paper cover. The black coating keeps ordinary light from the cell, but X-rays penetrate to the screen, which fluoresces. The photoelectric cell measures the intensity of the fluorescence, and thus the radiation power of the X-rays.

Radiophotography (*rād'ī-ō-jō-tōg'rà-fy*), the process of transmitting pictures by radio. The apparatus for sending and receiving such pictures consists of a scanning machine, a recording machine, and intermediate radio signals. The scanning machine bears a rotating cylinder or drum on which the picture to be sent is mounted. A tiny beam of light is projected on the picture, and while the drum rotates, the beam moves slowly until every part of the picture has been covered by the finger of light. The light reflected from the picture during this scanning is registered on a photoelectric cell, which changes light values into electric currents. Since black, white, gray, each reflect different amounts of light, the current from the photoelectric cell will vary in intensity. These currents from the cell are amplified and sent out by short-wave radio to the receiving station. There the recording machine, bearing a photographic film on a rotating cylinder, has been synchronized with the revolutions of the scanning machine. The incoming short-wave radio signals, by means of a galvanometer, are made to affect a light beam to give it corresponding intensity. The light beam is directed against the revolving drum of the recorder and the film registers the picture while it is being transmitted. The film is then developed in the usual manner.

For Wire Photos see *Associated Press; Phototelegraphy*.

Radiotherapy (*rā-dī-ō-thēr'ā-pī*). See *Radium*.

Radish (*rād'ish*), a fleshy plant grown extensively as a garden vegetable. It is thought to be native to India, where it was cultivated in ancient times, and was brought from that country to Europe and America. The radish is planted for its root, which is eaten as a salad or relish when young. Gardeners usually sow the seed at various times in the same year, thus insuring tender plants at different periods.

Radium (*rā'di-um*), a radioactive metal discovered in 1898 by Professor Curie and his wife, Madame Curie, of France. It is obtained from pitchblende, a mineral consisting largely of oxides

of uranium, but is difficult to procure in a pure state. It continually emits radiations of light and heat without combustion or an apparent loss of bulk or energy, but changes rapidly by oxidation. All of its properties are learned through its compounds, which are similar to those of barium in color and solubility. By its radioactivity it affects photographic plates through various opaque substances, discharges electrified bodies, and causes remarkable changes in living matter. The activity of this metal is measured by delicate electrical devices, which are far more sensitive than the spectroscope. Radium salts emit both heat and light and this property increases with the purity. The rays of radium reduce silver salts, transform white into red phosphorus, color glass and paper, and cause a sensation of light when brought near the closed eyes. Substances placed near radium salts become radioactive. The rays of radium cause serious burns when placed near the skin, not at once, but after a considerable time, which are difficult to heal. Similar burns appear to be caused by exposure to radioactive emanations from the atomic bomb.

Radium is employed in medicine for therapeutic purposes and to some extent for diagnostic uses. The best results have been obtained up to the present time in applications to such diseases as tuberculosis and in treating epithelial cancer. Chloride of barium is used to dilute the sulphide of radium, and in this form it is placed in a small rubber bag or disk which is fastened upon the affected part for whatever time the physician thinks it is necessary to produce the desired results. Another method is to place the salt of radium in a small cylinder, the open end of which is held near or directly against the affected part.

See also *Radioactivity; Uranium*.

Radius (*rā'di-ūs*), any line joining the center of a circle with a point on the circumference or any line joining the center of a sphere with a point on its surface. All radii of a circle or equal circles and of a sphere or equal spheres are equal. The radius of a circle is equal to $C/2\pi$, where C is the circumference and π is approximately 3.1416. Any curve in a plane or in space has a radius of curvature which is equal to the radius of the circle tangent to the curve at the point of tangency.

In anatomy, the external bone of the two bones of the forearm is called the radius.

Radon (*rād'ōn*), in physics. See *Uranium*.

Rae (*rā*), JOHN, Arctic explorer, born in the Orkney Islands, off Scotland, in 1813; died in London, England, July 21, 1893. In 1846 he made a journey to Repulse Bay and joined the expedition under Sir John Richardson that went in search of Franklin in 1848. Five years later he proved by an accurate survey that King William's Land is an island and discovered many relics of

Franklin's party. The British government awarded him \$50,000 for these services. Rae published interesting reports on the Eskimos and his Arctic expeditions.

Raeburn (*rä'búrn*), SIR HENRY, portrait painter, born in Stockbridge, Scotland, in 1756; died in 1823. He went to Italy at the age of 29, where he studied the works of the Italian masters. Returning, he settled in Edinburgh (1787). He was elected to the presidency of the Society of Artists in 1812, and was called to join the Royal Acad. three years later; he was knighted in 1822.

His portraits of such personages as Sir Walter Scott, James Boswell, and Dugald Stewart hang in many international galleries.

Raemaekers (*rä'mä-kērs*), LOUIS, cartoonist, artist, born in Roermond, The Netherlands, April 6, 1869; died in Scheveningen, July 26, 1956. He was best known for his anti-German political cartoons executed during World War I and World War II for the Amsterdam *Telegraaf*. His work also included landscape paintings, portraits, and graphic art. Among book collections of his cartoons were "*Devant l'Histoire*" (1918) and "Cartoon History of the War" (1919). The collection "Raemaekers and the War" was brought out in many popular editions, in 18 different languages. Raemaekers came to the U.S. in 1940, returning to The Netherlands after World War II.

Raff (*räf*), JOSEPH JOACHIM, composer, born near Zurich, Switzerland, May 27, 1822; died June 25, 1882. He was born of German parents, studied at Schwyz, and formed the acquaintance of Mendelssohn and Liszt, who inspired the young musician by warm commendations. In 1850 he settled at Weimar to draw inspiration from Liszt, and there wrote many of his best-known works. He married Doris Gemast, an actress, in 1859, and in 1877 became director of the Conservatoire at Frankfurt, a position he held until his death. Raff belonged to the Wagner school of musicians. Among his works are "Dame Kobold," a comic opera; "King Alfred," a historic opera; and "Lenore" and "Im Walde," two symphonies.

Raffia (*räff-i-ä*), a fiber obtained from the Jupati palm, used extensively in making matting and cordage. This tree is native to South America, where the natives gather the fiber and use it in making clothing.

Rafflesia (*räf-flē'zhī-ä*), a genus of plants native to the East Indies and the Philippines. Ten species have been described, all of which are parasitic. They are nearly rootless, stemless, and leafless, and consist almost entirely of flowers, which rise in the form of the heads of cabbage. One species bears a flower 3 ft. in diameter, weighing about 15 pounds; this is the largest bloom in the world. It was discovered in 1815 by Sir Thomas Stamford Raffles, a British officer and naturalist, in Sumatra.

Raglan (*räg'lan*), FITZROY JAMES HENRY SOMERSET, LORD, field marshal, born Sept. 30, 1788; died June 28, 1855. He was the youngest son of the fifth Duke of Beaufort, entered the army in 1804, and served on the staff of the Duke of Wellington in the Peninsular War. He was made commander of the English forces at the beginning of the Crimean War, in 1854, becoming field marshal for services in the Battle of Inkerman. His death resulted shortly after from dysentery.

Ragnarök (*räg-nä-rök'*), the name applied in Scandinavian mythology to the time when the world is to be dissolved, when the gods will come into mortal conflict with the spirits of evil. The Scandinavians believed that depravity and strife will herald the approach of this great event, when piercing winds will prevent the coming of summer. Then the ferocious wolf will be freed from its chains and the Midgard serpent will gain land, while the heavens will be rent in twain and the earth will become denuded of its vegetation. Odin, Vidar, and Thor are to be destroyed, and the earth is to be wrapped in fire and sunk beneath the sea. After Ragnarök has passed away, a new earth and a new heaven are to take the place of the old. It is to be the golden age of good and happiness, when the triumphant gods shall establish peace and good will among men forever.

Ragstone (*räg'stön*), a rough, impure limestone rock, which breaks into raglike fragments. It is useful for whetstones to sharpen steel instruments. The name is generally applied to hard, irregular rock overlying better grades of building materials, but which is used for building purposes.

Ragusa (*rä-gōō'zá*), a maritime town of Europe, in the southern part of Dalmatia, about 40 m. n.w. of Cattaro. In 1918 its name was officially changed to Dubrovnik. It was formerly an independent republic, but now possesses little of its former prosperity. The manufactures include clothing, oil, silk, leather, tobacco, soap, and utensils. Ragusa was founded about 656 by refugees from a city of the same name in Sicily, and in the time of the Byzantine Empire had a flourishing trade and important educational and manufacturing institutions. It became subject to Venice in the 13th century, but at the beginning of the 16th century it became a free city, which was finally overthrown by Napoleon in 1805. The town became a part of Austria in 1814 and of Yugoslavia in 1918. It was seized by Italy in 1941 and recaptured by the Allied armies early in 1945. Population, ca. 19,000.

Ragusa, an ancient city of Sicily, 30 m. s.w. of Syracuse, 15 m. from the Mediterranean. It is situated on the Ragusa River and occupies a site in the midst of a productive agricultural and stock-raising region. Among the manufactures are cotton textiles, woolen and silk goods, oil, wine, and utensils. In its vicinity are a number of an-

cient tombs and the city is surrounded by a substantial wall. Population, ca. 30,000.

Ragweed (*răg'wēd*), an annual plant found in the Temperate Zone of Europe and North America. It is so named from the ragged appearance of its leaves. Some species are locally called *hogweed*, since they are eaten by swine. The flowers appear in clusters, usually golden-yellow in color. This plant thrives in a wide variety of soils and grows profusely in uncultivated ground such as pastures and highway borders. Its pollen is a major irritant in asthma and hay-fever, and for this reason campaigns are frequently arranged for its local destruction.

Rahway (*ră'wā*), a city in Union County, N.J., on the Rahway River, 16 m. s.w. of New York City. It is on the Pennsylvania R.R. The manufactures include cereals, drugs, chemicals, clothing, utensils, machinery, and books. Population, 1950, 21,290.

Raikes (*ră'kē*), ROBERT, the founder of Sunday schools (*q.v.*), born in Gloucester, England, Sept. 14, 1735; died there, April 5, 1811. Succeeding his father as owner of the *Gloucester Journal* in 1757, he managed the paper until 1802. In 1780 he originated the system of Sunday schools by gathering a number of children from the streets for religious training. The last 30 years of his life were devoted largely to promoting schools of this kind, and he lived to witness the extension of the Sunday school system throughout all England.

Rail (*răil*), the name applied to many birds of the subfamily *Rallinae*, most of which are related to the coots and gallinules. These birds are widely distributed and include more than 150 species. Among the familiar birds of this group are the rails proper, the water hens, the coots, and the crakes. The *water rail* of Europe and the *Virginia rail* of North America are quite similar and form representative types. They have a long bill, long and powerful legs, an olive-brown or a bluish-ash color, and are about 11 in. in length. These species are highly esteemed for their flesh. The *Virginia rail* is a bird of passage. It feeds on worms, mollusks, and soft vegetable substances and is abundant in many parts of North America. It is very shy in its habits and, when detecting danger, escapes by passing swiftly through the reeds rather than by flight. The *fresh-water marsh hen* is about 21 in. long and is abundant in the marshes of the Southern states. Its body is 18 in. long, the bill is 3 in. long, and the weight is nearly 2 pounds. The *mangrove hen* is native to the West Indies, where it is found along the muddy shores and in marshes. The *land rail* is commonly known as *corn crake* and is about half the size of a partridge, but appears quite as large as that bird.

Railroads (*răil'rôdz*) or RAILWAYS, graded roads having one or more tracks of metal rails

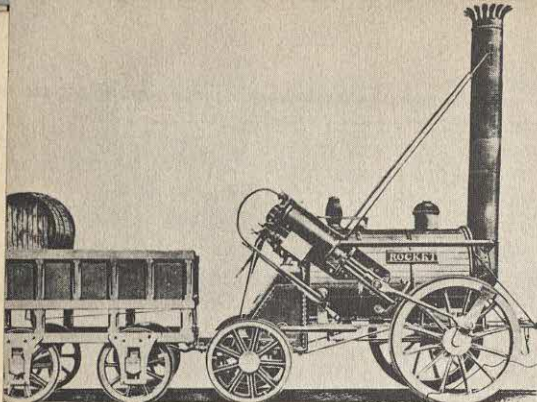
supported by ties or sleepers, designed for the passage of rolling stock.

HISTORY OF RAILROADS. It may be said that railroads are exclusively modern institutions, though similar improvements were utilized in a primitive way by the ancients. The Romans constructed grades and built tracks of two lines of dressed stones, connected end to end, so as to form hard, continuous surfaces for the passage of vehicles drawn by horses. Similar tracks constructed of two parallel lines of wooden beams, having flanges to prevent the wheels of the cars from leaving the track, were built in many parts of Europe early in the historic period. However, these were built principally within mines for transporting material to the place of exit, or for conveying mineral products to the places of use or shipment. Railways of this type were in general use in connection with the mines of Central Europe in the 16th century. It was not until the 19th century, however, that they began to be used for conveying freight. The rails consisted of timber; in 1676 additional wearing rails were provided to replace those worn out, and later flat strips of iron were nailed on the surface to add greater durability on curves and gradients.

Nicholas Cugnot, a Frenchman, was the first to invent, in 1769, a steam road carriage possessing some of the valuable elements later made successful by others. His second steam carriage, completed in 1790, is preserved as a remarkable curiosity in Paris. It has a pair of single-acting, 13-in. steam cylinders, by which power is communicated to a single drive wheel, and was designed for transporting artillery by highway. Though important as leading to the perfection of the steam engine, it is a mere toy when compared to the large modern machines.

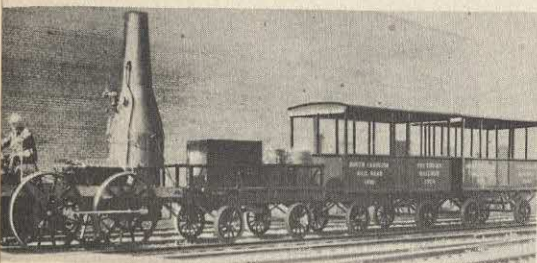
The invention made by Cugnot stimulated many mechanical engineers and scientists of Europe to devote marked attention to the construction of a machine that would combine the qualities necessary to move vehicles safely and rapidly over rails. This ambition to add materially to practical engineering soon spread to America, and Oliver Evans (*q.v.*), of Philadelphia, obtained a patent on steam carriages in 1787. Railroad building was delayed to a large extent by the construction of canals in many sections of Europe and America, and it was argued that no form of transportation could surpass water navigation from the standpoint of safety and low freight or passenger rates. Although this view was proved to some extent, railroad building still remained a favorite study, since it was desired to secure greater rapidity and to establish highways of travel and commerce where water navigation could not be utilized. It may be said that Oliver Evans was the inventor of the high-pressure double-acting steam engine, since his first product of

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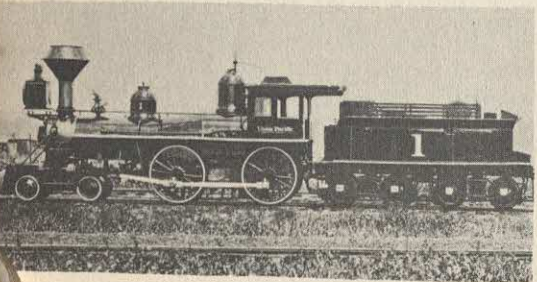
Courtesy Association of American Railroads, Wash., D. C.

THE "ROCKET," 1829



Courtesy Southern Railway

THE "BEST FRIEND," ABOUT 1830



Courtesy Union Pacific Railroad

THE "GENERAL SHERMAN," 1865

this class was completed in 1801-02. However, England claims that honor for Richard Trevithick (*q.v.*), who, about the same time, 1804, constructed an engine to draw wagons on rails. Oliver Evans built (1805) the first steam-propelled vehicle made in America that moved successfully on land.

Cast-iron rails were first used in England in 1738, but the first important use of such rails took place on the Coalbrookdale Railway in 1767. They were made in lengths of 5 ft. and a cast-iron flange was added later to aid in keeping the wheels on the track. "T"-rails came into use in 1831. The first steel rails were rolled in 1865.

For many years engineers entertained the mistaken notion that locomotives could not do their work successfully without having spur wheels, and mechanical engineers designed their en-

gines and tracks with this in view, but a coal operator of England, in 1813, successfully demonstrated that smooth wheels run more easily and successfully on smooth rails. This having been satisfactorily established, nothing more was needed than to provide a machine that would possess the desired amount of speed. In 1814 George Stephenson made a practical success in building a locomotive for railroad use. It was built with money advanced by Lord Ravensworth and ran 4 m. an hour. His later model, the "Rocket" (1829), was a complete success, running 30 m. an hour without load in the famous Rainhill Trials. The first railway opened in England was that from Stockton to Darlington, in 1825, and the second was built from Liverpool to Manchester in 1830.

UNITED STATES. The first railroad constructed in North America was completed in 1826 and extended from a granite quarry at Quincy, Mass., to the nearest tidewater, about 3 m. It was completed the following year and extended to Milton, Mass. The second railroad extended from mines near Mauch Chunk, Pa., to the Lehigh River and was completed in 1827. The New York Central (Mohawk & Hudson) was chartered in 1826, the Baltimore & Ohio in 1827, and the Boston & Albany (Boston & Worcester; Western Railroad of Mass.) in 1831 and 1833. The Baltimore & Ohio R.R. (horse-drawn) was the first in the U.S. to serve as a public carrier of passengers as well as freight. By May 24, 1830, it had opened for 13 m. of regular service between Baltimore and Ellicott's Mills, Md. However, the first steam locomotive train in the U.S. ran out of Charleston, S.C., in December 1830. In 1830 only 23 m. of railroads were completed and in operation in the U.S. Some engines used were of the Stephenson make and were imported from England. The first American-built locomotive actually to be operated on a common-carrier railroad in the U.S. was the "Tom Thumb," built in 1829 by Peter Cooper (*q.v.*) for the Baltimore & Ohio R.R.

The decades following were ones of experimentation in railway transportation. The great technical developments and outgrowths of railway history in the 19th century, abounding in hopes and ideals, the seemingly insurmountable obstacles, courageous planning, helpful Federal land grants, tremendous fortunes, engineering feats, and research, make a fascinating panorama. The nation's rail service proved itself of immeasurable value in both World Wars.

The U.S. has a larger railroad mileage than any other country in the world. In fact, the railway system of the U.S. includes almost one-third of the world's total railway mileage. In the U.S., railroads carry about 43 per cent of the nation's commercial freight traffic, 26 per cent of its com-

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mercial intercity passengers, and more than 75 per cent of the U.S. mails. Making up the huge but closely knit network of American railways are more than 600 separate operating companies, ranging from those of only a few miles to systems of thousands of miles in extent, owning immense fleets of locomotives and cars. Standardized equipment and smooth cooperation permit these many divisions to work as a unit, thus making it easy for a shipper or passenger to transfer from one line to another with a minimum of effort or delay.

Altogether, the railroads of the U.S. embrace ca. 219,000 m. of road (as contrasted with 2,808 m. in 1840) and some 352,000 m. of all tracks. Rail communications reach into every part of the country and connect at many border points with the railroads of Canada and Mexico.

At the beginning of 1961 there were in operation on the railroads of the U.S. about 31,178 steam, electric, diesel-electric, and turbine locomotives, 28,400 railway-owned and Pullman passenger-train cars of different types, 1,709,550 railway-owned freight-train cars (including 19,150 caboose cars), and 275,100 privately owned freight-carrying cars of various types.

In 1961 the railroads performed 20,287,000,000 passenger-miles of service at an average revenue of 3.078 cents per passenger-mile. The greatest source of revenue was freight. In 1961 they performed 563,304,000,000 ton-miles of service at an average revenue of 1.374 cents.

Ownership in the American railroads rests in nearly a million stockholders, individuals, trust funds, and fiduciary institutions distributed throughout the U.S. Railway bonds, representing one of the nation's important fields of investment, are widely owned by life insurance companies, savings banks, colleges, hospitals, and other institutions.

CONSTRUCTION. The first work in railroad building is to make a survey of the projected route between two places for the purpose of ascertaining the most practicable line, and for setting grade stakes to indicate the amount of cuts and elevations to be made. It is aimed to make the line as nearly level and straight as possible, since both are important factors in facilitating speed and promoting traffic without needless expense. To do this it is generally desirable to follow the valleys of streams wherever practicable, though in many sections it is necessary to penetrate hilly and mountainous regions. In an undulating country railroad builders aim to have the cuts supply the necessary amount of earth to build the embankments required in carrying the grade over depressions. Tunnels are cut only through the higher hills and mountains. Traversing a water-course involves construction of an opening (or culvert) or, for larger water-crossings, bridges or



THE FIRST TRANSCONTINENTAL RAILROAD

The East met the West when the Central Pacific and Union Pacific R.R.'s were finally joined by the golden spike during ceremonies at Promontory, Utah, on May 10, 1869

trestlework. In many regions where snowstorms or snowslides prevail it is necessary to protect the portions of railroad tracks passing through cuts by snow fences and snow-sheds.

After the grading and roadbed are completed, the *ties*, or *sleepers*, which carry the rails are placed across the grade at varying distances, center to center. On a typical railroad the center to center spacing of ties is as follows: principal main track, 19½ in.; other main tracks and running side tracks, 21½ to 22½ in.; yard and storage tracks, private and commercial sidings, 23½ to 25¼ in.; and bridge ties, 14 in. The length and weight of rails and the size of the ties are important factors in the spacing. The wood commonly used for that purpose includes white oak, yellow pine, chestnut, and hemlock. Afterward the roadbed is treated with a process called *ballasting*, which consists of embedding the ties in a layer of sand, gravel, or crushed stone. Modern rails are made of steel. They are spiked at a certain distance or width from each other, called the *gauge*. Three different gauges, known as *narrow*, *standard*, and *broad*, are in general use throughout the world. However, the railroads are chiefly of the standard gauge, which is 4 ft. 8½ in. (1.435 meters) wide, and the rails (about 39 ft. long) are made principally of the *T-shape*, so called from its resembling the form of the T turned upside down. One pair of parallel rails constitutes a single track of railway, two pairs, a double track; and with each system are a number of *side tracks* connected with the main line by *switches*.

EQUIPMENT. The cost of building railroad lines is only a portion of the general expense to be considered in construction and operation, since depots, freight offices, telegraph lines, and rolling stock are all important items to be added in

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estimating the general cost. Cars for the transportation of freight are variously constructed and include those designed particularly for way freight, grain, coal, oil, fruit, and other perishable commodities. The express and postal business is largely in connection with passenger trains, though on some lines express and postal services are carried on trains designed especially for those purposes.

The Baltimore & Ohio R.R. issued the first time-table for passenger trains in the U.S. in 1830. Sleeping cars were made as early as 1836, dining cars came into use in 1863, and George M. Pullman patented the vestibule car in 1887. Eventually the Pullman Co. supplied special Pullman sleepers and parlor cars to all railroads. Offering greater facilities and comfort than the regular coach cars, Pullman-car reservations require an additional fee from the passenger. In addition to improvements in physical property (installation of heavier rails, stronger bridges, better signals, electrification, etc.), modern passenger trains, including many streamliners, have made advances in safety, comfort and beauty; improved seating comfort, better lighting, ventilation, air conditioning, etc., have enabled the railroads to attract a large passenger traffic in spite of the competition of automobiles, trucks, buses, and airplanes.

Railroad locomotives are of three principal types—steam, electric, and diesel. The steam locomotive burns coal or oil to make steam, which actuates pistons connected with the driving wheels. The electric locomotive takes power from an outside source, such as overhead wires or a "third rail." In the diesel locomotive, liquid fuel injected into cylinders containing air under pressure is exploded by the heat of the air; the explosions drive pistons connected to electric generators, which in turn provide power for motors geared to the driving wheels. A fourth type of locomotive, in limited use on one U.S. railroad, is the gas-turbine electric. This is a locomotive in which high-pressure combustion gas directed against blades set in a rotating wheel produces power which is converted into electricity. Still another type is the diesel-hydraulic locomotive, which uses hydraulic power transmission in place of electric motors. Already proved effective in Europe, the last-named locomotive has been tested to determine its suitability for handling the heavier trains operated in the U.S. See also *Electric Railway*; *Steam Engine*; *Steam Turbine*; *Turbine*.

The first locomotive actually to perform heavy haulage was constructed by Richard Trevithick (q.v.), in 1803. The "Rocket" (1829) of George Stephenson (q.v.) is the ancestor of the modern steam railroad locomotive. The first locomotive operated in the Western Hemisphere, the "Stourbridge Lion," made one trip, on Aug. 8, 1829, but



Courtesy Union Pacific Railroad
AN EARLY PULLMAN DINING CAR OF THE 1870's

was too heavy for the track structure. The first locomotive built in the U.S. was Peter Cooper's "Tom Thumb" (1829-30). Rudolf Diesel patented in 1892 the basic principle of the present diesel locomotive. The first diesel locomotive of the modern type was used in New Jersey in 1925. The electric locomotive was first used on a standard-gauge railroad in the U.S. in 1885, in New York.

Diesel locomotives in 1961 performed 95 per cent of passenger service, 98 per cent of freight service, and more than 99 per cent of switching service in the U.S., consuming approximately 3,500,000,000 gallons of diesel fuel oil. Electric locomotives are second to diesels in the U.S., but they still predominate elsewhere. Steam locomotives haul the smallest amount of traffic on U.S. railroads but are extensively used on European lines.

Diesel locomotive units range from 600 to 2,400 horsepower per unit and may consist of one or more units. Most U.S. railroads now operate entirely with diesels. The diesel locomotive can run longer without servicing than the steam locomotive. It also has relatively higher horsepower output at low speeds; it is thus less dependent on speed for its horsepower output than is the steam locomotive and can start heavy trains more easily and smoothly.

Locomotives operate in three kinds of service, namely, freight, passenger, and switching. Dual-purpose diesel locomotives can be used for both road and switching service; this more intensive use reduces the number of locomotives needed as compared with steam operation. The diesel locomotive also has much greater efficiency in converting fuel into pulling power. While the steam locomotive can convert only about 6 per

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cent of the energy of its fuel into pulling power, the diesel converts approximately 25 per cent, so that although its fuel is more expensive than coal, it offers net savings in locomotive operation.

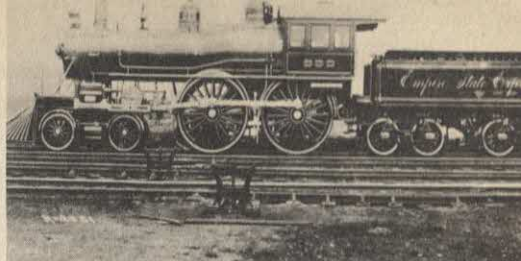
ELECTRIC AND OTHER RAILWAYS. After about 1890, heavy investments were made in railways powered by electricity, for urban, suburban, and interurban transit; but after about 1920, with the vast growth of motor transport in the U.S., their mileage tended to show a steady decline. (See *Electric Railway; Street Railway; Trolley Car*.) Only two major railways in the U.S. use "outside-source" electric power over long distances, the Pennsylvania and the Chicago, Milwaukee, St. Paul & Pacific. Late in the 19th century the need for rapid transit produced the elevated railway (*q.v.*), supported on steel trestlework above the streets, and built extensively in New York, Chicago, Boston, Berlin, Paris, and other cities. Because of their noise and unsightliness, which depressed real-estate values, many of these lines have been supplanted by the electric underground railway, or subway (*q.v.*). Subways are important transit facilities in New York, Chicago, Paris, Moscow, London, and other cities.

RAILROADS OF THE WORLD. In some countries, many commercial centers are so located that they may be readily served by river, canal, and coastwise navigation, thus requiring smaller railroad mileages than might seem adequate for their population and industries. Railroads are a major factor in the development of natural resources, especially in regions far from water transport or in areas of poor highway development. Countries having more than 10,000 m. of railroads are:

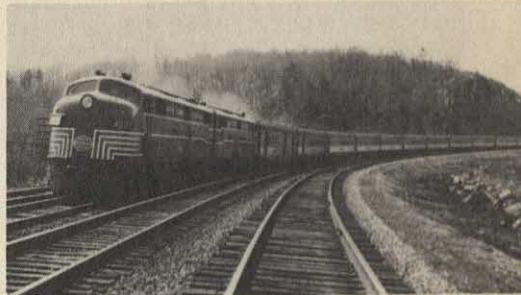
COUNTRIES	MILEAGE	COUNTRIES	MILEAGE
U.S. (incl. Alaska) . . .	218,936	China (incl. Manchuria) . . .	19,500
U.S.S.R.	76,767	Great Britain . . .	18,771
Canada	43,870	Poland	16,711
India	35,213	Mexico	14,577
Australasia . . .	29,182	South Africa . . .	13,504
Argentina	27,280	Japan	12,678
France	24,145	Spain	11,066
Brazil	23,253	Italy	10,190
W. Germany . . .	22,738	E. Germany . . .	10,028

The world's total railroad mileage is about 775,000 m. In the U.S., five railroads operate more than 10,000 m. of railroad: the Atchison, Topeka and Santa Fe Ry. leads, with 12,980 m.; the Southern Pacific Lines follow, with 12,017 m.; then the Chicago and North Western Ry., with 10,642 m.; the Chicago, Milwaukee, St. Paul and Pacific R.R., with 10,557 m.; and the New York Central R.R., with 10,086 m. Two other railroads operate nearly 10,000 m.: the Pennsylvania R.R., with 9,834 m.; and the Union Pacific R.R., with 9,705 m.

Rain (*rān*), the condensed vapor of the atmosphere falling to the earth in drops large enough



Courtesy New York Central Railroad
"EMPIRE STATE EXPRESS," 1893
 Locomotive #999 hauled the train at 112.5 m.p.h.



Courtesy New York Central System
THE STREAMLINED "EMPIRE STATE EXPRESS"



Missouri Pacific Railroad Co.
PLANETARIUM DOME COACH

Something new in comfort is the planetarium dome coach, which seats 46 in fully-reclining seats in the forward and rear first-level sections, and 24 in the dome. Spacious lounge rooms are located on the depressed floor level under the dome. The glass in the dome is heat-retarding and glare resistant. The dome is air conditioned by ducts in the ceiling

to obtain sensible velocity. It differs from *mist* in that the latter falls in very small drops or particles, and from fog, which is composed of particles so fine as to be not only individually

indistinguishable, but to float or be suspended in the air. A large amount of water vapor is always present in the air, but warm air is capable of holding a much larger quantity than cold air. The vapor suspended in the atmosphere is derived by evaporation of water from the surface of the earth, by far the largest part being taken up from the ocean, though there is a considerable evaporation from the land and interior bodies of water. The quantity of moisture that the atmosphere may hold depends upon the temperature, and, when it contains all that it is capable of holding it is said to be *saturated*, or at its *dew point*.

To produce rain, it is necessary that the temperature of a large mass of air be reduced considerably below its dew point. This condition may be brought about by a change of latitude, that is, a warm moisture-laden wind may blow into a cold region; or by a change of altitude resulting from an ascending current of air carrying the moisture of the lower strata into the upper regions. It is mainly in the latter manner that the rains of the tropical regions are caused, but the effect is similar in mountainous districts when a moist wind reaches a mountain range and is forced to ascend the slopes. When air moves from a lower to a higher latitude, rain does not usually appear. However, if the air mass also ascends, precipitation may take place. Rain is also caused by the mingling of masses of cold and warm clouds, though the precipitation from this cause is never considerable, since the colder air becomes warmed by the mixing, and thus acquires greater capacity for holding moisture.

As raindrops fall through the cloud they become larger as other drops unite with them, and thus their size depends upon the density of the cloud. Generally they are larger in the daytime than at night and are larger in the tropics than in the polar regions. The air is purified by rain falling through it, and by the mixture of the upper and lower strata of air resulting from its passage through the strata. Rain has a wholesome effect upon the earth, since offensive gases are washed from the surface by water flowing over it or passing into the soil. Fresh rain water contains a small quantity of ammonia and carbonic acid, on account of which it has a more wholesome effect upon plants than that derived from wells and springs. A great variety of circumstances affects the quantity of rainfall in different localities. Examples are nearness to the sea, exposure to prevailing winds, latitude, altitude, and the presence of mountain ranges. Rainfall is affected by the presence of vegetation, since an abundance of vegetable forms tends to aid condensation by keeping the soil cool, while a desert region becomes highly heated and directly counteracts condensation. More rain falls in the tropics than in

the temperate regions, and more descends in the temperate than in the polar regions. This is due to a decrease in the quantity of heat and evaporation with moderate regularity from the Equator toward the Poles.

The distribution of rain determines in a large measure the industries of the people, since without moisture any region is a mere desert and the subsistence of animal and vegetable life is either entirely impossible or greatly limited. The supply of rain in the vast interior of North America depends chiefly upon the winds blowing from the Gulf of Mexico. These winds are influenced in a measure by the elevated ranges of the Sierra Madre Mts., in Central America and Mexico, and thus are directed to spread themselves over the great basin of the Mississippi River. The movement of these winds may be traced from the equatorial regions to the vicinity of the peninsula of Yucatan, and as they proceed toward the north and west they appear to be elevated by a counter-current of colder winds near the surface. In moving from the lower to the higher latitudes they gradually give off their store of moisture. The quantity required in the upper part of the valley is perceptibly less than in the southern part, since the temperature is noticeably lower; thus the valley is adequately watered from the Gulf of Mexico to the regions extending far into Canada. Some of the moisture received by the Mid-Western states is carried over the Rocky Mts. from the Pacific Ocean by winds. The Atlantic coast plain and the western slope of the Pacific derive an abundance of moisture from the respective oceans, but there is considerable shortage of rainfall in the Pacific highlands and the slopes of the Rocky Mts.

Among the vast arid regions of the earth are the Sahara and Kalahari Deserts of Africa; the Arabian, Tarim, and Gobi Deserts of Asia; the coast of Peru; and the great interior of Australia. On the other hand, there are regions where rain falls almost daily or periodically with great excess, such as Patagonia, the lake regions of Africa, parts of India, and the northern part of Brazil. The quantity of rain which falls in a given time on any area is determined by means of an instrument called *rain gauge* (*q.v.*). The fall of snow, measured in a melted condition, is always included in reporting the total rainfall. The following statistics show the average rainfall of various places of interest: Cherrapunjee, India, 610 in.; San Luis de Maranhao, Brazil, 280 in.; Paramaribo, Guiana, 229 in.; Havana, Cuba, 91 in.; Sitka, Alaska, 90 in.; Western Sweden, 82 in.; Southern Germany, 27 in.; the British Isles, 40 in.; Washington, D.C., 38 in.; and San Francisco, Cal., 23 in. The average rainfall in the U.S. in the Semi-Tropical Zone is 39 in. and in the Temperate Zone, 34 in. In Canada the rainfall is greatest on the eastern and the western coasts, with a semi-arid

region on the eastern slope of the western highlands, where the rainfall ranges from 10 to 21 in.

ARTIFICIAL RAIN. Much attention has lately been focused on scientific experiments directed toward "rainmaking." Although artificial inducement of precipitation has often been attempted, it is only recently that experiments have been performed which offer some hope for success. Evidence accumulated in the laboratory and field has demonstrated that "seeding" of supercooled water clouds (clouds containing water droplets at temperatures below freezing) with dry ice can cause precipitation to fall. The process involves the transformation of supercooled water clouds into ice crystal clouds and the growth of the ice crystals to a size large enough to fall from the clouds as precipitation. Apparently very specialized atmospheric conditions are required to produce even a trace of precipitation, and scientists are currently making exhaustive studies to evaluate the results of seeding experiments. There is not yet enough knowledge of the processes involved to predict whether more than a few hundredths of an inch of precipitation can be produced under optimum conditions.

Rainalducci (*rī-nāl-dōōt'ché*), PIETRO, also called Pietro of Corbario, antipope (1328-30) known as NICHOLAS V, born in Corbaria, Italy; died in Avignon in 1333. When Louis the Bavarian captured Rome in 1328, he set up the Franciscan Pietro as antipope in opposition to Pope John XXII and received from him the crown of the Holy Roman Empire. In 1330, however, when Pietro found his position untenable, he made his submission to the Pope and was pardoned.

Rainbow (*rān'bō*), a luminous arch appearing in clouds opposite the sun, because of the refraction, internal reflection, and dispersion of light in drops of water falling through the air. In order for the bow to appear, there must be clear sun, no more than 40 degrees above the horizon, on one side, and a passing shower on the other. The light is thus decomposed into its simple colors, which always appear in the same order; namely, violet, indigo, blue, green, yellow, orange, and red. A perfect rainbow consists of two concentric arches centered on a point opposite the sun and therefore as much below the horizon as the sun is above it. The inner or brighter arch is called the *primary* bow; it is about two degrees wide and has an angular radius of 42°. The outer and fainter arch is called the *secondary*, which has an angular radius of 54°. In the primary bow, red is the outer color and violet the inner, while in the secondary bow the colors are fainter and arranged in a reverse order.

Rainbows are best seen in the morning or evening when the sun is low. Even then their extent is not over half a circle when viewed from a flat plain. An observer on a high mountain sees a

greater arc, and from an aircraft the rainbow can appear as a complete circle. The moon also produces rainbows, but they are faint and visible only under the most favorable conditions.

Rainbow Division, the name given to the 42nd Division (infantry) of the U.S. Army in World Wars I and II. It was so named because when the division was activated in August 1917 its personnel was composed of National Guard units assembled from 26 states and the District of Columbia. The unit served in many major actions, including the battles of Chateau Thierry, St. Mihiel, and the Meuse-Argonne. This division spent a longer continuous period in the front lines than any other division in the American Expeditionary Forces (*q.v.*). The Rainbow Division was reactivated (July 14, 1943) in World War II, took part in the critical Battle of the Bulge (winter 1944-45), and entered Germany in March 1945. It was inactivated on June 30, 1946. The insignia is a conventionalized rainbow.

Rain Gauge (*rān gāj*). See *Pluviometer*.

Rain-in-the-Face, American Indian chief, died in 1905. While Sitting Bull (*q.v.*), he was one of the leaders of the Sioux forces which annihilated the U.S. force of Gen. George A. Custer (*q.v.*) at the Little Big Horn River in Montana on June 25, 1876.

Rainy Lake (*rān'i lāk*), an inland lake of North America, which forms part of the boundary between Minnesota and Ontario. It is situated 160 m. w. of Lake Superior. Rainy Lake is about 50 m. long, has an average width of 5 m., and is 1,160 ft. above sea level. It contains numerous islands and is well known as a hunting and fishing area. It is drained by the Rainy River (*ca.* 85 m. long) into the Lake of the Woods.

Raisin (*rā'zīn*), the dried fruit prepared from the grape. The species of grapes containing a large quantity of sugar are of greatest value in making raisins. Several methods of producing raisins are in use. The best grades are made from choice grapes by cutting half through the fruit stalk without detaching it from the vine, thus leaving the cluster to shrink and dry by the heat of the sun while on the vine. Another method is to dip each bunch of grapes into a solution of lye made of the ashes of the burned tendrils, after which the fruit is dried by exposure to the sun. Raisins are sometimes dried in an oven, but these are of inferior quality. Large quantities of raisins are produced in California, but the principal producing areas are Spain, Asia Minor, Egypt, and other regions adjacent to the Mediterranean Sea.

Raisin River (*rā'zīn rīv'ēr*), BATTLE OF THE, an engagement at Frenchtown (now Monroe), Mich., in the French and Indian War. Gen. Harrison had sent a detachment of Americans under Gen. Winchester to take possession of Frenchtown, where he was surprised on Jan. 22, 1813,

by a force of British under Gen. Proctor. The Americans were defeated, but received assurances from the British that those left in the village would be protected from the Indians. After the British departed with their prisoners for Malden, the Indians massacred nearly 400 and took the balance away into captivity. After that event the Americans frequently used the cry, "Remember the Raisin River."

Rajagopalacharia (*rā'jā-gō-pā'lā-chā'ryā*), CHAKRAVARTI, Hindu political leader, born about 1879 in Hosur, Salem District, Madras, India. A lawyer, he first became a follower of Mahatma Gandhi in 1919, but quickly rose to a position of importance in the Congress party, becoming general secretary in 1921, acting president in 1934, and leader of the party in the Madras legislative assembly in 1935. He was premier of Madras from 1937 to 1939. After the Japanese bombed Pearl Harbor, he became the leader of a group within the Congress party which felt that non-violence, at least temporarily, was no longer a satisfactory weapon. He therefore urged the acceptance of Sir Stafford Cripps' proposals in 1942 and when Congress refused asked that the Congress and Moslem League leaders join in a coalition government. The Congress voted this proposal down, however, in favor of a resolution for a program of non-violence and non-cooperation against the Japanese and Rajagopalacharia resigned from the Working Committee. In 1946 he was a member of an interim Indian government and later of the Executive Council which governed India until the partition of India after which he became governor of West Bengal.

Rajah (*rā'jā*), or RAJA, a title borne originally only by the princes of the Hindu race, but now assumed by Malayan and Javanese chiefs as well.

Rajputana (*rāj-pōō-tā'nā*), an extensive division of India. It is bounded on the N. by Pakistan, E. by the United Provinces, S.E. by the Central India Agency, and W. by Bombay. The area is 132,559 sq. m. A large majority of the inhabitants are Hindus, but Brahmins, Mohammedans, Jains, and Christians are also represented. Population, ca. 14,000,000.

Rake (*rāk*), an implement with teeth or tines, which is used for collecting loose material or smoothing and evening a surface. Hand implements with parallel teeth fixed at right angles to a long handle are the simplest form of rakes. Two-wheeled farm rakes, drawn by animals or tractors, have curved tines between the wheels.

Raleigh (*rō'li*), the capital of North Carolina, county seat of Wake County, near the Neuse River, 147 m. N.W. of Wilmington. Communication facilities include the Southern and Norfolk Southern R.R.'s. Raleigh occupies an elevated site in the upper valley of the Neuse, about 320 ft. above sea level, and is surrounded by a fertile

region. The state capitol building is located in the center of the city and is surrounded by many beautiful state and Federal buildings. Other notable buildings include Wake County courthouse, the postoffice, the state penitentiary, the state geological museum, the state insane asylum, the State Coll. of Agriculture and Mechanic Arts, and the governor's mansion. In addition to the state college, other schools of higher learning include St. Mary's School, Peace Institute, Meredith Coll., Shaw Univ., and St. Augustine Coll. There are also four business colleges. Raleigh has two fine libraries and an art gallery. Pullen Park and the Confederate and National Cemeteries are beautiful public grounds. Raleigh is located in a rich agricultural area in which the principal crops are tobacco, cotton, and corn. The following commodities are manufactured in Raleigh: fertilizer, cottonseed-oil products, farm implements, textiles, worsted cloth, marbleware, washboards, doll furniture, dairy products, brick, cinder blocks, medicines, and millwork. Raleigh was chosen as a site for the state capital in 1792 and was incorporated two years later. In 1865, the city was occupied by Gen. Sherman. Population, 1930, 37,379; in 1940, 46,897; in 1950, 65,679.

Raleigh, SIR WALTER, navigator and statesman, born in Devonshire, England, in 1552; executed Oct. 29, 1618. He was descended from an ancient English family, entered Oxford Univ. in 1566, but in 1569 left without graduating to aid the French Protestants under Coligny. Later he joined a military force sent by Queen Elizabeth to aid the patriots in The Netherlands in their struggle against Spain, and in 1580 attained eminence by aiding to suppress a rebellion in Ireland. Raleigh was a man of handsome figure, tall, with a high forehead, and dark hair, and his imposing personality made him a favorite at the court of Elizabeth. He formed a scheme to colonize America in 1579 and was granted a charter for that purpose. In this enterprise he was assisted by his half-brother, Sir Humphrey Gilbert. His expedition was at first apparently successful in privateering against the Spanish, but his efforts to found permanent colonies in Virginia were made unsuccessful by Spanish encroachments. A large share of the forfeited estates of Ireland was granted to him in 1584. He introduced the culture of the potato in Ireland and was granted special trade privileges to strengthen his colonization scheme in America. He was knighted in 1585, and became captain of the queen's guard in 1587.

Raleigh, in 1588, rendered services against the Spanish Armada and later equipped vessels to drive the Spanish forces from strategic points. He privately married Elizabeth Throckmorton, a maid of honor in 1593 and thereby incurred the temporary displeasure of the queen. While banished from court, in 1595, he headed an expedi-

tion to Guiana, where he hoped to discover the fabled El Dorado, a supposed region of gold and gems. This expedition resulted only in his taking possession of the country in the name of Elizabeth, and on returning he published an account of the journey. Elizabeth reinstated him to royal favor shortly after his return, and gave him a naval command in 1596, under the Earl of Essex and Lord Howard, who sailed to destroy the Spanish fleet and capture Cadiz. The success of this enterprise was due in large part to Raleigh's efforts. He further served the queen by capturing Fayal, in the Azores, in 1597, and became governor of Jersey in 1600, but his brilliant career ended with the death of Elizabeth in 1603.



WALTER RALEIGH

James I had deep prejudices against Raleigh and immediately deprived him of every official position. He was accused of being implicated with Lord Cobham in a treasonable plot to secure the throne for Arabella Stuart, and, after a trial at Winchester, was found guilty and sentenced to be executed. This sentence was afterward commuted to life imprisonment in the Tower. He was confined there for 12 years and spent his time in literary and scientific research. He was released in 1616 to lead an expedition to the Orinoco River for the purpose of developing a vast gold field that he thought could be found there. The enterprise not only proved disastrous, but brought on trouble when Raleigh's men attacked and destroyed a Spanish village. He was arrested on returning to England, and was executed on the former sentence that still remained in force. While in the Tower he wrote a "History of the World."

Ram (*rām*), an ironclad ship of war having

its bow especially designed and constructed for ramming, but regarded as entirely valueless in modern warfare. See also *Ironclad Vessels*.

Rāma (*rā'mā*), in Hindu legends, the hero of the Rāmāyana, who made his appearance in the world at the end of the Treta Yuga or second age, and is called the seventh incarnation of Vishnu. He is generally spoken of as Ramachandra. Two other incarnations of Vishnu bear the name of Rāma, known as Balarāma and Parasara-rāma.

Ramadan (*rām-ā-dān'*), the ninth month of the Mohammedan year, the one in which Mohammed received his first revelation. It is, for this reason, the great annual fast month and festivities are kept up throughout the entire period, from sunrise to sunset. All believers are enjoined to abstain from eating, drinking, and sensual pleasures during the entire day, but food may be taken at night to supply the necessary wants of the body. The obligations enjoined upon believers during Ramadan are treated in the second book of the Koran called "The Cow." Since the Mohammedan months are reckoned by lunar time, each month begins in each successive year 11 days earlier than in the preceding, hence it occurs successively in all the seasons in a period of 33 years.

Raman (*rā'man*), SIR CHANDRASEKHARA VENKATA, physicist, born Nov. 7, 1888, in India. He was educated at the Presidency Coll., Madras, where he later taught. He has also been a lecturer at various other Indian institutions and in 1924 spent a year in the U.S. as research associate at the California Institute of Technology. From 1917 to 1933, he was professor of physics at the Univ. of Calcutta and later he became director of the Indian Institute of Science at Bangalore. In 1930 he won the Nobel Prize for physics for his works on the diffusion of light and for the discovery of the Raman effect, a diffraction phenomenon, which he had made two years earlier. He is the author of numerous publications on light and sound.

Ramayana (*rā-mā'yā-nā*), one of the two great epic poems of India, the other being known as Mahābhārata. This poem is the accredited work of Valmiki and recounts the famous exploits of Rama, King of Oude, who was one of the conquerors of Ceylon. It consists of 2,400 stanzas, arranged in seven books, and is thought to have been composed in the 5th century A.D. Many translations and criticisms on this work are extant, since it may be classed as the most celebrated poem in India. The translations of Schlegel are especially noteworthy.

Ramée (*rā-mā'*), LOUISE DE LA, novelist, born at Bury St. Edmunds, England, in 1840; died Jan. 25, 1908. In 1860 she settled in London and began to contribute to periodicals under the pen name of *Ouida*, by which she became known

extensively. Her first novel was published in 1863 under the title "Held in Bondage." She traveled extensively in Europe and resided for some time near Florence, Italy. Among her best-known writings are: "Under Two Flags," "Two Offenders," "A Dog of Flanders," "In Marmemba," "Views and Opinions," "Critical Studies," and "Village Commune."

Rameses (*rām'ê-sēs*), the name of several kings of Egypt, who are supposed to have reigned about the time the Children of Israel were connected with the Egyptians. Rameses I was the first sovereign of the 19th dynasty. He reigned but a short time and his name appears on the monuments of Thebes. Rameses II was the grandson of the preceding and is classed as the third king of the 19th dynasty. His birth is assigned to the 14th century B.C. The inscriptions on various tombs and monuments indicate that he was a patron of art and science and a builder of many vast improvements. It was during his reign that the Israelites were sorely oppressed,



RAMESES II KILLING A LIBYAN

Relief from Abusimbel, ca. 1250 B.C.

and under his son, Rameses III, who is generally known by his title, Pharaoh, the exodus of the Hebrews took place. The latter monarch belonged to the 20th dynasty.

Ramesseum (*rām-ê-sē'um*), the name of a temple built at Thebes, Egypt, by Rameses II. It was located on the west bank of the Nile, and its ruins attract many tourists. This temple was dedicated to the god Ammon and contained a colossal statue of Rameses II.

Ramillies (*rā-mē-yē'*), or RAMILIES, a town of Belgium in Brabant, 28 m. S.E. of Brussels. It is noted as the seat of an important battle in the War of the Spanish Succession, which occurred on May 23, 1706. The French forces were

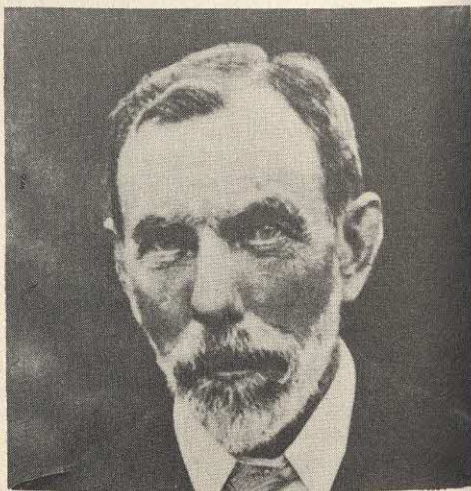
commanded by Marshal Villeroy and the elector of Bavaria, while the allied troops were under the command of Marlborough. The former were defeated with a loss of 13,000 men and France was compelled to abandon its claim to the Spanish Netherlands.

Rampart (*rām'pärt*), the embankment surrounding a fort, on which the parapet is raised, and which is designed to resist cannon shot. It is constructed immediately within a ditch; the lower part of the outer slope is usually made of solid masonry and the remainder is formed by the earth taken from the ditch. The height of the rampart is determined largely by the height of the buildings to be defended and by the character of the region surrounding the fort.

Ramsay (*rām'zī*), ALLAN, Scottish poet, born in Leadhills (Lanarkshire), Oct. 15, 1686; died in Edinburgh, Jan. 7, 1758. First a wig-maker, later a bookseller and founder of the first circulating library in Edinburgh, he wrote the pastoral comedy "The Gentle Shepherd" (1725). His "The Tea-Table Miscellany," and "The Ever-Green" (both 1724) include many old Scottish ballads and songs, as well as Ramsay's own poems.

Ramsay, DAVID, physician and historian, born in Lancaster County, Pennsylvania, Apr. 2, 1749; killed by an insane person, May 8, 1815. He was graduated from Princeton Coll., studied medicine, and established a successful practice at Charleston, S.C. He was a surgeon in the Continental Army during the American Revolution and a member of the Continental Congress. His principal writings include: "History of the American Revolution," "Life of Washington," and "History of South Carolina."

Ramsay, SIR WILLIAM, chemist, born in Glasgow, Oct. 2, 1852; died July 23, 1916. He studied



WILLIAM RAMSAY

in Glasgow and in Tübingen, Germany, and was professor of chemistry at Univ. Coll., Bristol (1880), and Univ. Coll., London (1887-1913). He discovered the following "inert gases": argon, in 1894 (with Lord Rayleigh); helium, in 1895; krypton, neon, and xenon (with M. Travers) in 1898. Devoting himself to study of radioactivity, he discovered niton in 1910 (with Whytlaw Gray). He was awarded the Nobel Prize for chemistry in 1904. His works include: "A System of Chemistry" (1891), "The Gases of the Atmosphere" (1896), and "Modern Chemistry" (1901).

Ramses (*rām'sēs*). See *Rameses*.

Ramsey (*rām'zī*), ALEXANDER, politician, born near Harrisburg, Pa., Sept. 8, 1815; died Apr. 22, 1903. He was graduated from Lafayette Coll. and engaged in a political career. In 1841 he was made clerk of the Pennsylvania house of representatives and was elected to Congress in 1842 as a Whig, serving four years. He became the first territorial governor of Minnesota, and held that office until 1853. Two years later he was elected mayor of St. Paul. He served as governor of the state from 1860 to 1863. In the latter year he was elected to the U.S. Senate, where he served for 12 years. In 1879, he became Secretary of War under President Hayes, and was a member of the Utah Commission in 1882.

Ranch (*rānch*), a term applied in the western part of North America to an establishment for rearing and grazing cattle and other stock in large numbers. The name was derived from the Spanish word *rancho*, meaning a hut or collection of huts in which ranchmen mess and lodge. Ranching has long been an important business and involves the rearing of large herds of cattle, horses, ponies, and sheep. For nearly half a century the ranchmen and cowboys had almost uninterrupted possession of many sections of the great plains, but the region is now becoming more thickly settled, and the vast open ranges have been limited by fencing for agriculture.

Rancidity (*rān-sīd'ī-tī*). See *Fat*.

Randall (*rān'dal*), SAMUEL JACKSON, politician, born in Philadelphia, Pa., Oct. 10, 1828; died in Washington, D.C., Apr. 12, 1890. He first engaged in business in Philadelphia, became state senator in 1858, and served two years in the Union Army, attaining the rank of captain. In 1862 he was elected to Congress as a Democrat, but served again in the army in the Gettysburg campaign. His Congressional service included a period of 28 years and he was Speaker of the House from 1876 to 1881. Randall was a leader of the protectionist wing of the Democratic party, opposed the Force Bill in 1875, and served on a number of important committees.

Randolph (*rān'dolf*), ASA PHILIP, Negro labor leader, born Apr. 15, 1889, in Crescent City, Fla.

Educated at the City Coll. of New York, he became co-founder in 1915 of a radical magazine for Negroes, *The Messenger*. In 1917 he organized a union of elevator operators in New York. In 1925 he began the organization of what later became the Brotherhood of Sleeping Car Porters. After many setbacks, his union won a contract with the Pullman Co. embodying important improvements in wages and hours. The union also obtained a charter from the American Federation of Labor, the only all-Negro union to do so. During World War II Randolph fought for Negro equality in war plants and in the armed services. He organized and directed the March on Washington movement which led President Franklin D. Roosevelt to inaugurate the Committee on Fair Employment Practices in 1941. Since 1957 Randolph has been a vice president of the American Federation of Labor-Congress of Industrial Organizations.

Randolph, EDMUND JENNINGS, soldier and statesman, born in Williamsburg, Va., Aug. 10, 1753; died in Frederick County, Virginia, Sept. 12, 1813. He was the son of John Randolph, a royalist, who disinherited him because he sided with the Americans and joined Washington's army. After studying law, he was admitted to the Virginia bar. He was a member of the Virginia constitutional convention in 1776, and in the same year succeeded his father as attorney-general. He was a delegate to Congress from 1781 to 1782, governor of Virginia from 1786 to 1788, and in 1789 became Attorney-General of the U.S. President Washington appointed him Secretary of State in 1794 to succeed Jefferson, but he resigned the following year on account of a misunderstanding in relation to the Jay Treaty. Subsequently he practiced law in Richmond, Va., and served as a counsel in the trial of Aaron Burr for treason. He wrote a history of Virginia.

Randolph, JOHN, statesman, born in Cawsons, Va., June 2, 1773; died in Philadelphia, June 24, 1833. He was descended from a wealthy family of Virginia, was a second cousin of Edmund J. Randolph, and traced his ancestry to Pocahontas (*q.v.*), the famous Indian princess. His education was secured at Princeton and Columbia Colls. He was elected to Congress as a Democrat in 1799 and served, except for two terms, until 1825. He served as U.S. Senator for two years, from 1825 to 1827. He opposed Madison and the War of 1812, and was led into a duel with Clay by styling the union of Adams and Clay a "coalition between the blackleg and the Puritan." His opposition to the War of 1812 caused his defeat for Congress. Randolph was a strong defender of the doctrine of "states rights." President Jackson appointed him minister to Russia in 1830 and he was elected to Congress in 1832, but died of consumption before taking his seat. Randolph pro-



Courtesy Brown Bros., N. Y.

JOHN RANDOLPH

vided in his lifetime for freeing his 300 slaves.

Randolph, PEYTON, statesman, born in Williamsburg, Va., in 1723; died in Philadelphia, Pa., Oct. 22, 1775. He was graduated from William and Mary Coll., studied law in London, and in 1748 was given an appointment by the king as attorney general of Virginia. He was a member of the Virginia House of Burgesses (1748-49, 1752-75). In 1765 he prepared the remonstrance passed by the House of Burgesses against the passage of the Stamp Act. The following year he resigned as attorney general and was chosen speaker of the House of Burgesses. He was President of the First Continental Congress that assembled in Philadelphia on Sept. 5, 1774, and also when that body reassembled on May 10, 1775. He died of apoplexy the following October.

Rangers (*răn'jêrz*), equivalent in the U.S. armed forces to the British Commandos (*q.v.*), forming a task force specially trained and equipped to make spot raids or advance raids on enemy positions. The term Rangers derives from Rogers' Rangers, organized by Major Robert Rogers during the French and Indian Wars to wage war against the Indians with Indian tactics.

In World War II, Rangers were U.S. infantrymen selected for their qualities of leadership or specialized training in a given field. They received intensive infantry training with emphasis on the doctrine of a personal fight carried to the enemy. Each soldier became a specialist in all types of fighting rather than in just one.

Rangoon (*răn-gōon'*), the capital and chief seaport of the Union of Burma, on the Rangoon River, 20 m. from the sea. The Rangoon River is the eastern branch of the Irrawaddy, and the city is situated along the left bank, its dock being on the opposite side of the river, at the suburb of Da-la. Rangoon is an important railroad and trade center. It has rice mills and manufactures of

RANKE

clothing, lumber products, pottery, and utensils. The trade in timber, ivory, rice, hides, cotton, precious stones and gums is important. The most noteworthy structures include the government buildings, St. John's Coll., a number of hospitals and schools, and numerous churches, mosques, and temples. A majority of the people are Burmese, but it has a considerable number of Hindu inhabitants. A city has existed here since many centuries before the Christian era, but its prosperity dates from the 18th century, when it was captured and rebuilt by the Burmese. The British took possession in 1852. The city was taken by Japan in World War II and recaptured by the British in May 1945. Population, *ca.* 400,000.

Rainier (*rā-nēr'*), MOUNT. See *Tacoma*.

Ranjit Singh (*răn-jêl' sîng'h'*), founder of the Sikh kingdom, born Nov. 2, 1780; died June 27, 1839. He succeeded his father in 1792 as head of a branch of the Sikh confederacy. With the aid of a strong military force he annexed Lahore (1799) and Amritsar (1809) and decided to unite all the Sikh provinces into one dominion. Subsequently he seized Multan, Kashmir, and Peshawar, and by 1820 had organized the Punjab into the Sikh kingdom.

Rank (*răngk*), RELATIVE, term used in the armed forces of the U.S. to signify the precedence of officers. The following list indicates the relative rank of combatant army and air force officers and their equivalent in the navy:

ARMY AND AIR FORCE	NAVY
General of the Army ¹	Fleet Admiral
General	Admiral
Lieutenant General	Vice Admiral
Major General	Rear Admiral
Brigadier General	Commodore
Colonel	Captain
Lieutenant Colonel	Commander
Major	Lieutenant Commander
Captain	Lieutenant
First Lieutenant	Lieutenant (Junior Grade)
Second Lieutenant	Ensign

Ranke (*răn'kê*), LEOPOLD VON, historian, born in Wiehe, Thuringia, Germany, Dec. 21, 1795; died in Berlin, May 23, 1886. He studied at Halle and Berlin, and in 1818 became a history teacher at a school in Frankfurt-on-the-Oder. In 1825 he was appointed professor of history at the Univ. of Berlin, in recognition of his first work, the "History of Latin and Teutonic Nations, 1494-1514," and in 1841 he became also historiographer of Prussia. He continued to lecture at Berlin until 1871. Ranke's importance lies in his finding of new and original material for historical research and in his searching analysis and interpretation of this material. He thus started an entirely new school of historians. His chief works are "The Roman Popes, Their Church and Their State in

¹ The air force does not have a five-star general ranking with "General of the Army."

the 16th and 17th Centuries" (1834-36), and "History of the World" which he began in the 81st year of his life. Among his other works (a total of 54 volumes) are: "German History in the Period of the Reformation," "History of England, Principally in the 16th and 17th Century," "History of France, Principally in the 16th and 17th Century," and "Wallenstein."

Rankin (*rāŋ'kīn*), JEANNETTE, member of Congress, born near Missoula, Mont., June 11, 1880. Educated at the Univ. of Montana, where she became an instructor in economics, she afterward studied in Seattle, at the Univ. of Washington. She traveled extensively, visiting Europe and New Zealand, and gave much time to research work in social and economic conditions. In 1914 she conducted a successful campaign for woman suffrage in her state, and was elected the first woman member of Congress in 1917. Re-elected in 1941, she served until 1943. She voted against the declaration of war on Germany in 1917 and was the only member of the House of Representatives who voted against the declaration of war on Japan in 1941.

Rankin, JOHN ELLIOT, politician, born in Itawamba County, Mississippi, March 29, 1882; died in Tupelo, Nov. 26, 1960. He was graduated from the Univ. of Mississippi (1910) and practiced law in Tupelo. He was prosecuting attorney (1911-15) and served (1921-53), as a member of the Democratic party, in the U.S. Congress for 16 consecutive terms. He was coauthor, with George William Norris (*q.v.*), of the bill creating the Tennessee Valley Authority (*q.v.*); he also gave strong support to the Saint Lawrence Seaway and Power Project (*q.v.*). With Theodore Gilmore Bilbo (*q.v.*), he shared the leadership of the Southern members in Congress, where he was a master of parliamentary debate. For a time he was a member of the House Committee on Un-American Activities, which he helped to establish.

Ransom (*rān'sūm*), MATHEW WHITAKER, soldier and U.S. Senator, born in Warren County, North Carolina, Oct. 8, 1826; died Oct. 8, 1904. He commanded a brigade at Antietam. Gen. Lee complimented him for efficient service at Hare's Hill in 1865, and he remained active until the surrender at Appomattox Court House. In 1872 he was elected to the U.S. Senate and served continuously until 1895.

Ranunculus (*rā-nūn'kū-lūs*), a genus of herbaceous plants of the buttercup family, several common species of which are known as *buttercup*, or *crowfoot*. The flowers have five or more petals and numerous stamens, and the seeds are grouped into a head or cluster. The leaves of most species are much divided, the roots are bulbous, and some species have acrid and caustic properties. *Buttercups* are among the

more common species and are found largely in meadows, while *crowfoots* and *spareworts* are equally well known, the former growing mostly in pastures and the latter in marshes and wet places. More than 100 species have been described. A double-flowered variety, known as *bachelor's button*, is cultivated in some regions as a flowering plant. It has a tall stem and white or yellow flowers.

Rapallo (*rā-pāl'lō*), an Italian resort on the Gulf of Genoa, 16 m. E. of Genoa. It exports olive oil, lace, fish, and coral. Population, ca. 14,000.

Here, on Nov. 6, 1917, an Allied War Council met to discuss the critical situation arising out of the Italian defeat at Caporetto during World War I. The Treaty of Rapallo between Italy and Yugoslavia, Nov. 12, 1920, adjusted the frontiers between these two countries and established Fiume (*q.v.*) as a Free State, connected with Italy on the west by a narrow corridor along the sea; at the same time Italy obtained Zara on the Dalmatic coast. During an international conference held here in 1922, the German and Russian governments concluded a treaty of mutual recognition which was considered of significance since none of the Great Powers had then recognized the Soviet government.

Rape (*rāp*), a biennial plant which is cultivated extensively in Europe, principally for the leaves and the seed. It is closely related to the cabbage family, but it has a root like that of the turnip, this portion being esculent and useful as an article of food. A species known as *summer rape* is well known in England and France, being cultivated largely for *colza* oil obtained from the seed. This oil is used for machinery and lamps in lighthouses. The seed is fed to cage birds. Rape is not only valuable as a forage crop and for the root and seed, but is useful to plow under as a fertilizer.

Raphael (*rāf'ā-ēf*), OF RAFFAELLO SANZIO, painter, born in Urbino, Italy, Apr. 6, 1483; died at Rome, Apr. 6, 1520. He was the son of Giovanni Sanzio, a painter, who died in 1494. From him the son received his first instruction, but he was afterward entrusted to the care of an uncle, who placed him in the studio of Perugino at Perugia. He studied under this well-known painter for six or eight years. He went to Florence in 1504, where he painted until 1508, and then was invited to Rome by Pope Julius II. His paintings were at first influenced to some extent by the manner of Perugino, but at Florence he began to develop a new and independent style.

Raphael's works are generally grouped in three classes: those executed in the manner influenced by Perugino, those produced under his Florentine style from 1504 to 1508, and those executed after settling in Rome. Transition to the latter style is first recognized in his "Dispute of the



SISTINE MADONNA. PAINTING BY RAPHAEL

Fathers of the Church." Though each style has its peculiar merit, it may be said that his last manner exhibits the most classical features, since it was influenced largely by his contact with numerous productions of the classical period. The long series of Raphael's Madonnas, his most beloved topic, clearly proves this development which began with such tender representations as the so-called "Madonna del Granducca," "La Belle Jardinière" (strongly showing Leonardo's influence), "Madonna della Sedia," and led up to the crowning and most famous "Sistine Madonna." As a portrait painter he is known for his excellent representations of the Popes Julius II and Leo X, which are full of vivid observation. He won immortality, however, by his large mural compositions with which he decorated the papal residence in the Vatican. Most famous among them are "The School of Athens," "The Triumph of Religion," "The Deliverance of Peter from Prison," and "The Conflagration of the Borgo." The rich Roman banker, Chigi, commissioned him to decorate his Villa Farnesina, a task which he executed with the assistance of his large workshop. This decoration, telling the story of Cupid and Psyche, proves that the great master was also able to work in a lighter vein. Together with Leonardo, Michelangelo, and Titian, he is considered one of the leading masters of the Renaissance. The last famous work he undertook was his "Transfiguration of Christ," which was left unfinished at his death and is in the Vatican.

Rapid City (*rāp'īd sīt'y*), a city in South Dakota, seat of Pennington County, on Rapid

Creek. It is served by the Chicago & North Western R.R. The eastern gateway to the Black Hills region of caves, hot springs, mines, and scenery, it is a center for tourists as well as mining and lumbering industries. Its manufactures include cement, flour, and meat and dairy products. Rapid City is the seat of South Dakota School of Mines and Technology. Settled in 1876, it was incorporated in 1882. Population, 1950, 25,310.

Rapier (*rā'pī-ēr*), a straight sword used only for thrusting. The blade is highly tempered and finely pointed and was formerly used extensively in duels. It is now used for fencing (*q.v.*) and as a decorative item in state ceremonials.

Rappahannock (*rāp-pā-hān'nūk*), a river in Virginia, which has its source in the Blue Ridge Mts., and, after a course of 225 m. toward the southeast, flows into Chesapeake Bay by an estuary about 70 m. long. It is navigable to Fredericksburg, 110 m. The principal tributary is the Rapidan. On these two rivers occurred the important battles of Fredericksburg, Chancellorsville, and the Wilderness, in the Civil War.

Rapunzel (*rā-pūn'zēl*), character in the German fairy tale, Rapunzel's Golden Ladder. See also color plate in Volume I.

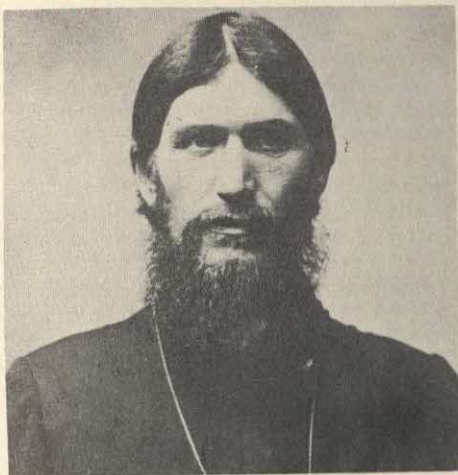
Raritan (*rār'i-tan*), a river which rises in Morris County, New Jersey, and flows southeast into Raritan Bay. It is 70 m. long and is navigable to New Brunswick.

Rasmussen (*rās'mūs-en*), **KNUD**, explorer, born at Jakobshavn, Greenland, June 7, 1879; died there Dec. 21, 1933. He studied in Denmark, but returned to Greenland and explored much of the then unknown regions of the Arctic Ocean. In 1906 he visited Smiths Sound Bay, remaining two years, and in 1910 made a trip to Cape York on Melville Bay. He contributed much to our knowledge of the Polar Eskimos. He published "In the Home of the Polar Eskimos."

Raspberry (*rāz'bēr-rŷ*), a shrubby plant belonging to the same genus as the blackberry. It is cultivated extensively as a garden fruit. The old plants have many suckers, the stem is characterized by slender prickles, and the leaves are pinnate. It is native to America and the northern part of Europe and Asia. The cultivated species have been greatly improved and about 500 different kinds have been described. They include red, yellow, and black species, and the fruit resembles the strawberry in not becoming acid in the stomach. The ripened fruit is used in making jam, jelly, and various liquors and is eaten as a dessert. Different kinds of medical preparations are made of it, including compounds of use in fevers and for expectorants. Wild species are found in many sections of the U.S.

Rasputin (*rās-pōō'tēn*), **GREGORY EFIMOVICH**, monk, court favorite, born in Tobolsk province, Siberia, 1871; murdered in 1916. Of peasant

origin, he was poorly educated. He lived in his native village until he was 33, then left his wife and family to become a priest. He gained



Courtesy Brown Bros., N. Y.

GREGORY RASPUTIN

entree into St. Petersburg society (1907) and became the favorite of Czar Nicholas II and the Czarina.

He was thought by many to have an evil influence on church politics as well as on the national and foreign policies followed by the Czar. To end this allegedly intolerable situation, a group of noblemen murdered him on Dec. 31, 1916.

Rastatt (*rä'stät*), or RASTATT, fortress and town in Baden, Germany. Located in the southwestern part of Germany on the Murg River, Rastatt is noted for its manufacture of steel goods, paper, beer, and tobacco products. Historically important, it contains the castle of the margraves of Baden-Baden constructed during the 18th century. In the same period the town was witness to the signing of two treaties, the first, in 1714, to end the War of the Spanish Succession, the second, in 1799, in the nature of a conference between Germany and France. Huge fortifications were built in Rastatt during the 19th century. In World War I, the town was bombed from the air by the French. Following World War II, it came under French occupation. Population, ca. 14,000.

Rat (*rät*), a class of rodent mammals belonging to the mouse family, but including only the larger species. A number of species have been described. They infest houses, barns, and ships. Most rats have a slender head and a long, scaly tail. The *Norway* or *brown rat* is about 9 in. long, and is the largest and most powerful. The *black rat* has a somewhat shorter body, a longer tail, and larger ears. These two kinds are native to

Central Asia, where other allied species also prevail. Rats were unknown in Europe until the 16th century, when the black rat made its appearance, and about two centuries later the brown rat became common to the western part of Europe. Both are now distributed in America and are hostile to each other. The brown rat being stronger, it either kills or drives the black rat from a locality when it once gets a permanent foothold. Rats feed on many kinds of animal and vegetable food, and to obtain it they burrow in the ground or gnaw through wooden structures. They devour eggs, small poultry, birds, grain, and vegetables and make their way into warehouses and dairies. The rat multiplies very rapidly. Its flesh is eaten only by rude tribes and animals, though its skin is used to a considerable extent in making gloves. The *white rat* belongs to this class of animals and is occasionally seen as a household pet. A species known as the *cotton rat* is common to the southern part of the U.S.

Ratchet (*räch'ët*), a mechanism for holding or propelling a ratchet wheel. It consists of a pawl or click, which fits into the teeth of a circular wheel, as in the carriage of a typewriter, where it turns a wheel by degrees. The windlass and derrick furnish examples of ratchets that prevent the backward movement of a wheel.

Ratel (*rä'tël*), a mammal of the badger family, sometimes called *honey badger* from its fondness for honey. The size is that of the badger, but it is somewhat heavier and has a less projecting nose. The ratel native to South Africa burrows in the ground for its dwelling and searches for the nests of wild bees, against whose sting it is protected by its loose and leathery hide. The ratel of Asia has a shorter tail, is about 3 ft. long, and is nocturnal in its habits. It feeds on small animals and insects and is said to prey upon imperfectly buried human bodies.

Ratio (*rä'shí-ó*). See *Proportion*.

Rationalism (*rä'shün-äl-iz'm*), a concept in theology and philosophy which upholds the supremacy of human reason as a guide to knowledge and wisdom. Its contrast is supernaturalism (*q.v.*).

In theology, rationalism states that all alleged revelations must be judged by "natural human reason." Thus, it is antiauthoritarian and often identical with general liberalism or so-called modernism. Although this current appears within the Roman Catholic Church (*q.v.*) at various times (see *Scholasticism*), it is most conspicuous in Protestantism. Physical or natural causes are employed as explanations of the stories of the Bible and, as Luther (*q.v.*) declared at the Diet of Worms in 1521, neither the Pope nor the councils of the church could compel him to yield the thinking of his reason, even applied

to religion. Zwingli and Calvin joined him in this conviction. Later on, the so-called Deists (*q.v.*) stretched rationalism so far that they criticized not only individual Christian dogmas but even the idea of revelations. The so-called "Esprits forts" of the French Enlightenment (*q.v.*) of the 18th century went still farther and drove rationalism to the borderline of materialism (*q.v.*).

In Germany, at the same time, rationalism extended only into the analysis of theological systems, without touching the contents of religion themselves. Lessing and Herder (*qq.v.*) represent this trend, which climaxed in the writings of Kant ("Religion within the Limits of Reason"). He almost identifies religion with ethical principles. The ideas of God, liberty, and immortality are Kant's main topics of rationalistic thinking. In this concept, moral principles can be formulated by rational deduction; they need not be confirmed either by empirical experience or by any theological revelation. Actually, therefore, most non-Catholic moral philosophers after Kant are rationalists, working in the same direction. In Catholicism, ethical rationalism believes that morality can be understood by rational thinking, although at the same time it is confirmed by the revelation of God.

In another nearly philosophical sense, rationalism means the deductive method of drawing conclusions from *a priori* elements or axioms. No empirical method is needed in this concept. Furthermore, rationalism means all philosophical trends which hold that reason is the last source of knowledge, even beyond and independent of the experience of the senses. Locke and Leibnitz (*qq.v.*) are the main representatives of this school of rationalism.

In spite of this critical analysis, rationalists often gave in to spiritual and religious considerations, sometimes not without a slight break in their rationalistic considerations. The most striking example in this respect is, again, Kant. Although his *ratio pura* (pure reason) denies any value of experience, he strives to build up a metaphysics, which seems to be an insoluble contradiction. See also *Kant, Immanuel*.

The true rationalist believes that reason is self-sufficient in explaining everything, even the deepest religious and philosophical problems and ideas, a concept which is denied by the intuitionist and the supernaturalist. See also *Intuitionism*.

Rational Number (*ră'shūn-əl nūm'bēr*), a term in mathematics. See *Number*.

Ratisbon (*răt'is-bōn*). See *Regensburg*.

Raton (*răt-tōn'*), county seat of Colfax County, New Mexico, 20 m. s. of Trinidad, Col. It is on the Atchison, Topeka & Santa Fe R.R., and is surrounded by a farming and stock-raising country. In its vicinity are productive deposits of coal. It has grain elevators, stockyards, and

extensive railway shops. Population, 1950, 8,241.

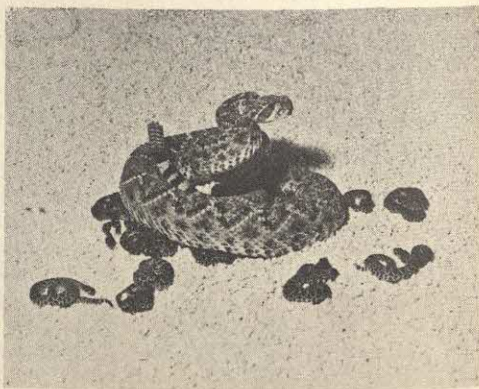
Rattan (*răt-tăn'*), the name applied commercially to the long and flexible stems of several species of climbing palms and to the more rigid stem of certain erect palms. The former are very tough and strong and are used for many purposes, such as making ropes, seats of chairs, cables, baskets, mats, hats, and various kinds of wickerwork. The stems of the erect palms are used mostly for walking sticks. Rattan is produced largely in Sumatra, Java, and other islands southeast of Asia. It is sold in the export market in bundles of 100 canes, each measuring from 15 to 20 ft. in length.

Rattlesnake (*răt'tl-snāk*), the general name of several species of venomous snakes, so named because they have a series of horny scales at the end of the tail, which clash together with a rattling sound when the tail is vibrated. The rattle is a complicated organ and appears in very young rattlesnakes, before they have shed their skin for the first time. When the skin is renewed, a new joint appears next to the body of the snake, while the old one is not cast off with the remainder of the epidermis. Thus, there are as many loose joints in the rattle as there have been renewals of the skin of the snake. The number does not indicate the age of the snake, since the skin is changed oftener than once a year, but it does indicate the number of changes of skin that the animal has undergone. The rattles are dry, horny, and cup-shaped, each fitting over a portion of the preceding and tapering toward the farther end. They give off a peculiar sound when shaken, unless wet by rain or dew, when no sound can be produced.

Rattlesnakes are native to America, and include about 15 species. They are sluggish in habit, but pursue squirrels, rabbits, mice, and other animals upon which they prey with considerable skill. The poison is one of the most

RATTLESNAKE AND YOUNG

Courtesy N. Y. Zoological Society



deadly found in serpents and if allowed to penetrate the nerve centers rapidly has deadly effect. The *prairie rattlesnake* attains a length of about 3 ft. and is found in many sections of the Western states, where it shares burrows in common with prairie dogs and owls. The *banded rattlesnake* occurs east of the Mississippi and reaches a length of from 4 to 6 ft. Other and larger species are found in Mexico, Central America, and South America.

Rauch (*rouk*), CHRISTIAN DANIEL, sculptor, born at Arolsen, Germany, Jan. 2, 1777; died at Dresden, Dec. 3, 1857. He studied sculpture at an early age. At the death of his father, in 1797, he went to Berlin and became valet to Emperor Frederick William III, who recommended him to the Acad. of Fine Arts. In 1804 he visited Rome, where he became acquainted with Thorwaldsen and Canova and received patronage from William Humboldt, then Prussian minister at Rome. His works include statues of many famous Germans. His greatest work, however, is the monument of Frederick the Great in Berlin, which was completed after 20 years of labor, and was dedicated in 1851. Rauch deserves to be called the founder of the Berlin school of sculpture.

Ravel (*rä-vêl'*), MAURICE JOSEPH, composer, born at Ciboure, France, in 1875; died in 1937. He moved to Paris in 1887, and in 1899 entered the conservatory there. His music received early acclaim, and he was known as one of the greatest impressionists. He composed the operas: "L'Heure Espagnole" (1911), "L'Enfant et les Sortilèges" (1925), and "Pour ma Fille" (1927); the ballet, "Daphnis et Chloë" (1912), and many orchestral works including "Ma Mère l'Oye," "Bolero," and "La Valse." See also *Music*.

MAURICE RAVEL



Raven (*rä'v'n*), a species of crow, widely distributed and remarkable for its large size. It is about 2 ft. from the bill to the tail, and its extended wings measure nearly 3 ft. The plumage is glossy black. Its bill is thick and short, the tail is rounded. The raven is capable of flying high into the air. Ravens are able to scent carrion several miles away, and they congregate in the vicinity of dead animals, their favorite food. They also feed on fruits and tender shoots of plants. They are noted for being long-lived and may be taught to imitate human speech. Ravens are noted in literature, being the first birds to be mentioned in the Old Testament, and they are alluded to in classic mythology as birds of ill omen. Shakespeare mentions the appearance of the raven as foreboding misfortune, while Poe makes it a prominent figure in "The Raven."

Raven, THE, a poem by the American poet Edgar Allan Poe (*q.v.*), written in 1845.

Ravenna (*rä-vên'nä*), a city of Italy, capital of a province of the same name, 4 m. w. of the Adriatic Sea and 42 m. s.e. of Bologna. It is located in a fertile region, has wide streets, and is surrounded by walls. In former times the sea extended to the city, but now its harbor is silted up, and the connection with the Adriatic is by a canal. A railroad line connects it with the great railroad system of northern Italy, giving it convenient trade facilities. Among the manufactures are silk textiles, pottery, utensils, clothing, musical instruments, and machinery. Its streets are adorned with a number of statues of the popes and the city is generally rich in monuments of art. The principal buildings include a cathedral, numerous churches, and a library containing 100,000 volumes. It has numerous educational institutions, museums, gardens,

RAVENNA. MAUSOLEUM OF THEODORIC



and parks. Ravenna is a very ancient city and is thought to have been founded by the Umbrians. Emperor Honorius made it the capital of the Roman Empire, but its greatest prosperity was attained under Theodoric the Ostrogoth, who was buried here. It became the metropolis of the Lombards in 752, but they were expelled by Pepin and Charlemagne, who presented it to the pope. It continued as an exarchate to the pope until 1860. Population, 1961, 115,205.

Rawalpindi (*rā-vāl-pīn'dē*), capital of Pakistan and of the Rawalpindi district, in West Pakistan, ca. 150 m. n.w. of Lahore. Called the gateway to Kashmir and situated on the railroad from Lahore to Peshawar, Rawalpindi is an important commercial and industrial center and grain market. Its industries include locomotive works and iron foundries. During British rule and before the partition of India, the city was a military station; it is the site of an arsenal and fort. With establishment (1947) of Pakistan as an independent state, Rawalpindi became headquarters of the Pakistani army. In 1962 it replaced Karachi as the capital. Population, 1961, 343,000.

Rawlins (*rō'linz*), a city in south central Wyoming, seat of Carbon County, 118 m. s.w. of Caspar. Served by the Union Pacific R.R., it is a business and commercial center. Its industries include truck transportation and the milling of uranium, which is mined extensively in the area. The surrounding farm lands produce sheep, dairy cattle, and hay; beekeeping is an important industry. The site was settled in 1867 and named Rawlins Spring in honor of Gen. John A. Rawlins (*q.v.*), who stopped there during a journey through the West. Rawlins was made the seat of the newly formed Carbon County in 1868 and incorporated in 1886; it became a first-class city in 1928. Population, 1950, 7,415; in 1960, 8,968.

Rawlins, JOHN AARON, soldier and cabinet officer, born in East Galena, Ill., Feb. 13, 1831; died in Washington, D.C., Sept. 9, 1869. After attending public school and working as a charcoal burner, he studied law. In 1854 he became a member of the Illinois bar and established a practice in Galena. Elected city attorney in 1857, he supported Stephen A. Douglas for the Presidency in 1860 and opposed armed liberation of the slaves. At the beginning of the Civil War, however, he supported the Administration and became aide-de-camp to Gen. Ulysses S. Grant. He accompanied Grant in practically all his campaigns and battles from Cairo to the surrender of Gen. Robert E. Lee. In 1865, a brigadier general, Rawlins was appointed chief of staff, and in 1869 President Grant named him Secretary of War, a position he held until his death.

Rawlinson (*rō'lin-s'n*), SIR HENRY CRESWICKE, soldier and diplomat, born in Chadlington, Eng-

land, April 11, 1810; died in London, March 5, 1895. He was educated at Ealing, Middlesex, and in 1927 entered the military service in India, serving in the Bombay presidency until 1833. In the latter year he reorganized the Persian army and served in Afghanistan from 1840-43. He was consul at Bagdad in 1850 and became consul general for Turkey in 1851. He was made director of the East India Co. in 1856 and returned to India. In 1859 he was sent as special envoy to Persia. Beginning in 1858 he was a member of Parliament for a number of years.

A student of Oriental languages and cuneiform writing, Rawlinson published (1846-51) a transcription and interpretation of the inscription of Darius I at Behistun, Persia. With his brother, GEORGE RAWLINSON (1812-1902), he made a translation of Herodotus, and he aided George Smith in publishing "Cuneiform Inscriptions of Western Asia." Among his many and varied writings is an account of Eastern political affairs, "England and Russia in the East" (1875). In 1871 Rawlinson became president of the Royal Geographical Society, and in 1891 he received a baronetcy.

Ray (*rā*), a genus of cartilaginous fishes, divided into numerous families, included the sawfishes, electric rays, skates, sting rays, and eagle rays. The *sawfish* has an elongated body and a protruding snout armed with cartilaginous tubes. Called the saw, this snout is a formidable weapon on which the fish is able to impale its prey. The *electric ray* has organs by which it generates electricity for use in defense or as a means of killing the smaller animals on which it feeds. The *skate*, or *thornback ray*, is so named from its curved spines. The *sting ray* is peculiar for its vertical fins and barbed spine, with which it is able to inflict painful wounds. The *eagle ray* has highly developed pectoral fins, a dilated body, and a very thin tail. More than 100 species of rays have been described, ranging in weight from a few ounces to 1,500 lb. Species of the genus are distributed more or less widely in all of the seas.

Rayburn (*rā'būrn*), SAM(UEL TALIAFERRO), Congressman, born near Kingston, Tenn., Jan. 6, 1882; died in Bonham, Texas, Nov. 16, 1961. He was graduated from E. L. Mayo's Normal School (now East Texas State Coll.) and was elected (1906) to the Texas house of representatives. There he was elected speaker at the age of 29, while also studying law at the Univ. of Texas. In 1912, as a member of the Democratic party, he was elected to the U.S. House of Representatives; he served there for 49 years (longer than any member before him). In 1940 he was elected speaker, a position he held for a total of 17 years, or twice as long as any speaker before him; his tenure was broken twice (1947-49, 1953-55) when Republicans controlled the Congress.



Photo by Harris & Ewing, Wash., D. C.

SAM RAYBURN

Opposed to isolationism, he backed the Marshall Plan and the liberal legislation of his party in general with the exception of civil-rights measures, which he supported only after 1957.

Rayleigh (*rā'li*), JOHN WILLIAM STRUTT, 3rd BARON, physicist, born in Langford Grove, Essex, England, Nov. 12, 1842; died in Witham, Essex, June 30, 1919. Educated at Cambridge Univ., he was professor of experimental physics there (1879-84) and professor of natural philosophy at the Royal Institution (1887-1905). Lord Rayleigh did research in almost every branch of physics, but his most important work was in optics and capillarity, Boyle's law at low pressures, and theoretical and experimental acoustics. With William Ramsay he discovered argon in 1894. His work in optics led to the discovery of new laws concerning the scattering of light, through which he arrived at an explanation of the blue color of the sky. He won the 1904 Nobel Prize in physics for his research on the density of gases and his discovery of argon.

Raynaud's Disease (*rē-nōz' dī-zēz'*), in medicine, a condition in which the arteries and arterioles of the fingers, sometimes the toes, and rarely the ears and nose undergo paroxysmal contraction. During an attack, which may last from a few minutes to an hour, the affected members are pale, cold, and numb. When the spasm relaxes, color returns, and there is a sensation of burning. The immediate cause is cold or emotional stress. The condition may be primary, or it may be secondary to other diseases. It occurs with greater frequency among women than among men.

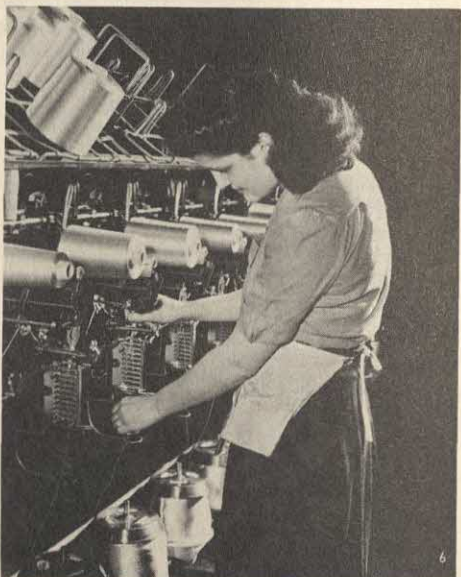
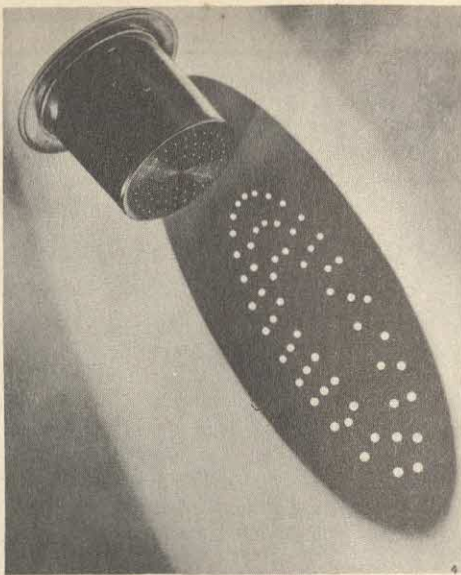
Rayon (*rā'ōn*), a name given (1924) to a man-made textile fiber. Rayon is a generic word used for filaments made from cellulose by pass-

ing or drawing a cellulose solution through an orifice and then solidifying it in the form of a thread. The cellulose used in the manufacture of rayon filaments is obtained from two natural sources: from the solid parts of the cell walls of wood pulp from pine and spruce trees, and from cotton linters, the short fibers of cotton which are not suitable for spinning into cotton thread.

The conversion of the cellulose into rayon filaments may be accomplished by various chemical processes:

In the viscose process, cellulose is treated with caustic soda and carbon bisulfide to form a viscous liquid of about the color and consistency of honey. This substance, called viscose, is forced through holes directly into a chemical bath, which restores the liquid to a solid. When washed and bleached this filament becomes a continuous rayon thread which, in chemical composition, is the same as the original cellulose. Viscose rayon fiber was first produced in the





Courtesy American Viscose Corp., Marcus Hook, Pa.

PROCESS OF MANUFACTURING VISCOSE RAYON

1 Cellulose, obtained from cotton and from specially treated wood pulp of trees such as the spruce, is fed to the mill in sheets like blotting paper. 2 Caustic soda is added to cellulose. 3 After adding carbon disulphide, the "crumb," or matted substance, is dissolved into a honey-like liquid called *viscose*. 4 Forced through a spinneret, the viscose forms fine filaments or threads. 5 Yarn resulting from the many filaments is twisted by a revolving spindle. 6 The yarn is reeled into skeins prior to being washed, bleached, and dried. It is then wound on cones, spools, or tubes and sent to the fabric mills for weaving or knitting

U.S. in 1911, and now provides about 65 per cent of U.S. rayon volume.

In the cuprammonium process, purified cellulose, either exclusively from cotton linters, or from a combination of cotton linters and spruce pulp, is treated with copper sulfate ammonia,

which dissolves the cellulose; the liquid thus obtained is forced through a spinneret into a mild chemical bath, which coagulates it into a continuous rayon thread. This type of rayon was first made in 1927 and currently provides about 4 per cent of U.S. rayon volume.

By either of these processes, rayon filaments are produced in the form of a continuous thread of predetermined length and diameter and may be delivered to cloth mills on cones or spools, ready for weaving. A more popular form of use for rayon, however, is in staple fiber form. In this instance, the filaments are cut into predetermined lengths immediately after spinning, processed, dried, and shipped in bales to the weaving mill. There they are processed into yarns in much the same manner as cotton and other natural fibers.

Fabrics made of rayon can be woven as sheer as the finest silk or as thick as the most wind-resistant wool. Rayon is especially receptive to finishes against stains, perspiration, and gas-fading, properties which have made it adaptable for use both in clothing and home furnishings. In addition, the absorbency of untreated rayon is greater than that of any other fiber, a characteristic which has made it useful in increasing quantity in the manufacture of medical and hygienic products.

Rayon filaments can be engineered with great strength, making them useful in many industrial applications, such as reinforcing tires, belting, hose, and specialty papers.

New cellulosic research technology has created modified rayon staple fibers, called high wet modulus fibers, with dry strength greater than cotton and wet strength equal to cotton. These modified rayons are adaptable to a wide range of blends with other fibers, natural and synthetic, contributing strength and dimensional stability, ease of wash-and-wear finishing, and soft, luxurious texture.

Current world production of rayon totals ca. 5,000,000,000 lb., of which ca. 40 per cent is filament and 60 per cent staple rayon. Of the ca. 40 countries producing rayon yarn, Japan leads in volume, with the U.S. and West Germany close competitors. See also *Plastics*; *Silk*.

Razor (*rā'zēr*), a knife of a peculiar shape and with a keen edge, used to shave the hair from the face or the head. The best quality of steel is used in making razors and the sides of the blades are usually drawn or ground concave. The blade is held to the handle by a rivet, which facilitates turning it in a position most convenient for shaving. Razors of this kind are used almost exclusively by barbers, while safety razors, which are fitted with a guard to prevent cutting the face, are chiefly used in home shaving.

Ré (*rā*), an island of France, in the Bay of Biscay, belonging to the department of Charente-Inférieure. It is 17 m. long and 4 m. wide. Oysters, wine and salt are the principal products. The island is located opposite La Rochelle and is strongly fortified. Population, ca. 14,700.

Reaction (*rē-āk'shun*), in chemistry, the

transformation of matter into one or more different substances. With a reaction is associated an energy change. The weight of materials entering into the reaction equals the weight of the materials produced, whether they be solids, liquids, or gases, or a combination of these. Because of this weight relationship, a chemical reaction may be stated mathematically as an equation. This relationship illustrates the law of the conservation of matter, i.e., in a closed system, matter can be neither created nor destroyed, but it may be transformed.

In psychology and medicine, term signifying the action by which one responds to a given stimulus; also reciprocal or reflex action or return of a previous mood or condition after an interval of experiencing the opposite condition.

Read (*rēd*), OPIE PERCIVAL, author, born in Nashville, Tenn., Dec. 22, 1852; died in 1939. He was educated at Neophogen Coll., Gallatin, and took up journalistic work at Little Rock, where he founded *The Arkansas Traveler*, a weekly publication devoted to literature and humor. Later he became highly popular as a platform and Chautauqua lecturer. Among his best-known writings are "Len Gansett," "A Tennessee Judge," "A Kentucky Colonel," "Wives of the Prophet," "The Jucklins," "The Carpetbagger," and "Our Josephine and Other Tales."

Read, THOMAS BUCHANAN, poet and painter, born in Chester County, Pennsylvania, Mar. 12, 1822; died in New York City, May 11, 1872. He studied sculpture and painting in Cincinnati, Ohio, and spent several years in traveling, supporting himself by sign painting and working as a cigar maker. In 1846 he opened an art studio in Philadelphia, but went to Italy in 1850. Later he established his permanent residence at Rome, though he continued to make occasional visits to the U.S. He spent considerable time painting scenes from personal observations in the Civil War and at that time wrote his best-known single poem, entitled "Sheridan's Ride." Other writings include "Female Poets of America," "House by the Sea," and "Wagoner of the Alleghenies." His principal paintings are "Sheridan and His Horse," illustrating the above-mentioned poem, and "Spirit of the Waterfall."

Reade (*rēd*), CHARLES, novelist, born at Ipsden House, Oxford, England, June 8, 1814; died Apr. 11, 1884. Among his best-known works are "It Is Never Too Late to Mend," "Griffith Gaunt," "A Terrible Temptation," "The Course of Love," "Christie Johnstone," and "The Cloister and the Hearth."

Reading (*rēd'ing*), the process of acquiring meanings from printed or written symbols. In its early stages, learning to read means learning to recognize the printed symbols and to think of the corresponding spoken word. The reader

must learn to look systematically across the page from left to right, to improve the speed and accuracy of his recognition, and to develop complex and delicate eye-movement habits. He must be able to understand the thoughts that are expressed by single words, phrases, sentences, and paragraphs. The superior reader not only grasps the author's meanings but also judges them from a critical point of view. Becoming a good reader involves learning a large number of interrelated habits and skills and takes place gradually over a period of several years.

READING READINESS. Not all children are ready to begin the study of reading when they reach the age of six years. To be able to learn the beginnings of reading easily, the child should: (1) be mentally equal or superior to the average six-year-old; (2) be physically healthy, with normal vision and hearing; (3) have a good understanding of English and be able to speak it in simple but complete sentences; (4) be able to interpret pictures and to notice similarities and differences in pictures, alphabet letters, and word forms; (5) have had the opportunity to visit many places where he can acquire new ideas; (6) be able to take part as a member of a group, pay attention, and follow directions; and (7) be interested in stories and in learning to read. Many children who enter the first grade are not yet ready in some of these respects. In an increasing number of schools, first-grade children are not started on reading until they show that they are ready to learn it. For many children, a delay of half a year is helpful; a few children are not ready for reading until they are seven or eight years old. It does a child more harm than good for him to be pushed into reading before he is ready for it.

TEACHING READING. Children are no longer started on reading by learning the alphabet. The alphabet method was uninteresting and difficult for most children. In the majority of schools, the children start by reading from large charts and from little books called pre-primers. New words are taught one or two at a time. The children learn them by a "look and say" method; no attention is paid to the letters; instead, the children learn to recognize the words by their general appearance. The children read repetitious stories in which the same words are used over and over. Pictures are used to show what the word says. Most beginners find it easier to recognize a whole word as a unit than to remember it by its spelling or by the sounds of its letters. After reading two or three pre-primers, the children go on to primers and then to first readers, second readers, etc. In a good school, children read many easy books and are not pushed quickly into hard books. They learn to read well by doing a large amount of easy reading.

Although a whole-word method is usually used

at the beginning, it is important for children to learn how to figure out the pronunciation of words that they do not recognize. The teaching of letter sounds and "word families" is usually started in the second half of the first grade, and the major part of instruction in phonics is given in the second and third grades. Children should learn the sounds of single letters and the common phonograms, combinations like *sh*, *ate*, etc., and should be given systematic practice in sounding words and putting the sounds together. They should not be encouraged to spell the word when they do not recognize it, but should be taught to use the letter sounds. By the third or fourth grade, they should begin to pronounce longer words by syllables.

Even in the first grade, much of the reading is done silently. Oral reading is necessary in the first three grades to check on the accuracy of reading and to detect errors. Silent reading absorbs most of the reading time from the fourth grade on. Reading textbooks are less used and more emphasis is placed on "reading to learn" than on "learning to read." Three types of reading become important: careful study of textbooks, reference reading to find information on special topics, and recreational reading for pleasure. More difficulty is caused by ignorance of word meanings than by inability to pronounce words. Specific reading skills, such as skimming, getting the central thought, reading for details, and following directions, are developed through special practice exercises. Children are taught to locate information through use of the index and table of contents, to use a dictionary, and to outline or summarize what they read. Practice to speed up reading is also given in some schools.

At present, little attention is given in most secondary schools and colleges to the teaching of reading. If there is a reading program in the school, it is usually intended only for those whose reading ability is poor.

READING INTERESTS. Children in the first three grades usually enjoy short, fanciful stories about talking animals, fairy stories, and realistic stories about children like themselves. They like action, excitement, surprise, and humor. The fairy story is most popular at the age of eight or nine. Boys of 10 to 14 generally enjoy adventure and mystery stories, historical tales, animal stories, and reading about science, inventions, mechanics, and hobbies. Girls tend to like sentimental stories of home and school life, and also enjoy adventure and mystery. Most children enjoy the "comics," which are really cartoon-style serial stories; some do no voluntary reading except in comic books. In the early teens girls begin to read romantic fiction and love stories. Both boys and girls begin to read adult books during the teens. There are marked individual differences in the degree of

READING

liking for reading, the amount of reading done, and the kinds of reading matter enjoyed.

To increase a child's interest in reading, the most important thing is to provide a child with books that are both easy enough so that he can read them without hard work, and in line with his interests. Parents who want to select good books for their children should consult the children's librarian in the nearest public library. She can give helpful suggestions, and can also recommend published book lists in which the parent can look up suitable books.

The reading of adults is influenced greatly by their education and general cultural background. Nearly everyone reads newspapers and about four adults out of five read magazines, but fewer than half ever read a book. Of the books and magazines that are read, a large proportion are light and trashy fiction.

READING DISABILITY. A child is said to have a reading disability if his reading is poor for his age and intelligence. Unfortunately, about one boy in every five and about one girl in 10 fail to learn to read as well as they should. Some poor readers cannot do any better because they are dull. There are, however, some children who are otherwise bright but who fail in reading. There are many possible causes for such failure: physical handicaps, excessive absence from school, poor teaching, nervousness and emotional difficulties, and dislike for school are among the commoner causes.

If the child's intelligence is normal, special help called *remedial reading* often produces marked improvement. Milder forms of reading disability usually can be treated successfully in the classroom. Reading disability is a kind of educational sickness, and needs expert study and treatment if the child is to recover from it. Parents should not wait for a child to "grow out of" backwardness in reading; the problem usually gets worse each year if it is not given proper attention. Punishment and nagging to try harder usually do not help at all. The more extreme cases should be taken to a trained psychologist or to a psychological clinic for careful study to find out the reasons for their poor progress. The causes should be found out and corrected; otherwise intensified teaching may do no good. Some school systems have special remedial reading classes, and many colleges and teacher-training schools maintain reading clinics.

A book which has proved very useful to teachers and will help parents to recognize the reasons why the child has become a poor reader and the faults in his reading, and to find out how the child can be helped is A.J. Harris' "How to Increase Reading Ability." It describes in detail the causes of poor reading and the approved methods of dealing with each of the common reading



READING, PA. PUBLIC MUSEUM AND ART GALLERY

faults, such as poor word recognition, lack of understanding, poor memory for what is read, dislike for reading, slow reading, etc. For the high school student, college student, or adult who can read fairly well but wants to improve his reading skills, any of the following can be used as a guide to self-improvement: R. Strang, "Study Type of Reading Exercises," F.O. Triggs, "Improve Your Reading," and W.B. Pitkin, H.C. Newton, and O.P. Langham, "Self-Improvement in Reading."

Reading (*rēd'ing*), a town in Middlesex County, Massachusetts, 12 m. N. of Boston. It is on the Boston & Maine R.R. and is a popular suburb. It has manufactures of rubber goods, musical instruments, and stoves. It was settled in 1639 and incorporated in 1664. Population, 1940, 10,866; in 1950, 14,006.

Reading, county seat of Berks County, Pennsylvania, 58 m. N.W. of Philadelphia. It is on the Schuylkill River, the Schuylkill Canal, the Pennsylvania and the Philadelphia & Reading R.R.'s, and several surfaced highways. It covers an area of 8 sq. m., and the locality is more or less rolling or hilly. East of it is Mt. Penn and south is Neversink Mt., both of which are reached by improved roads. These eminences have a height of about 995 ft. and afford a fine outlook over the surrounding country.

The city has a fine system of public schools. It is the seat of two commercial and business schools, the Albright Coll., and a number of charitable institutions and hospitals. Near the city, at Kutztown, is the Kutztown State Teachers Coll. The Lutheran Trinity Church, the county courthouse, the Federal building, and many fine churches are among the noteworthy public buildings. Much of the architecture in the city is modern and substantial, especially the business blocks and office buildings, such as the Metropolitan

Edison Bldg., the Bell Telephone Bldg., and the Colonial Trust Bldg. Concerts, opera, and other musical programs enjoy considerable patronage.

Reading is situated in a fertile farming and dairying region, and the agricultural resources are well developed. In the city are located the extensive shops of the Philadelphia & Reading R.R. The manufactures include brick, pipe tobacco and cigars, machinery, locomotives, pottery, castings, hosiery, underwear, textiles, pretzels, shoes, and fabrics. It has a large wholesale and jobbing trade and is a shipping point for cereals, livestock, and fruit. The city was settled in 1733 and laid out in 1748 by Thomas and Richard Penn, sons of William Penn. Reading was incorporated as a borough in 1783, but was chartered as a city in 1847, when it had a population of 12,000. Population, 1940, 110,568; in 1950, 109,320.

Reading, a county and parliamentary borough of England in the county of Berkshire, is situated 36 m. w. of London at the junction of the Thames and Kennet Rivers. It is also a junction for the Great Western and Southern railways. Its history dates back to Saxon times, and in 870 it was seized by the Danes; later it was visited by several reigning monarchs and was involved in serious fighting in the Civil War and in the invasion of William III, of Orange, in 1688. Its architectural interest is centered in the ruins of the Benedictine Abbey founded by Henry I and in the Church of St. Laurence, both of which were begun in 1121. The town is now the seat of the county administration; the parliamentary borough returns one member to Parliament. Reading contains a university, noted for agricultural studies; a municipal library, museums, and an art gallery; Assize Courts; a county hospital, and several schools and churches. It is also noted for its manufactures—particularly the world-renowned biscuits (cookies) made by Huntley & Palmer, Ltd., whose factory is the most extensive of its kind in the world. Other industries include iron foundries and engineering works, seed-growing, malting and brewing, boat building, and the making of bricks and pottery. There are also large grain, flour, and cattle markets to serve the surrounding agricultural country. Pop., ca. 100,000.

Reading, RUFUS DANIEL ISAACS, FIRST MARQUESS, statesman, born in London, in 1860; died in 1935. He became a barrister in 1887, and was made queen's counsel 11 years later. Entering the House of Commons on the Liberal ticket (1904), he was solicitor general and attorney general (1910), having been knighted that same year. He was the first attorney general to enter a British cabinet (1912). As Lord Chief Justice (1913-21), he visited the U.S. (1915) to arrange a \$500,000,000 loan from America to the Allies. He returned as a special envoy in 1918. He was viceroy and governor general of India (1921-26),

and foreign secretary of Great Britain (1931).

Reagan (*re'gan*), JOHN HENNINGER, senator, born in Sevier County, Tennessee, Oct. 10, 1818; died Mar. 6, 1905. In 1839 he moved to Texas, which was then an independent republic, and after studying law was admitted to the bar. In 1852 he was elected judge of the ninth judicial district, serving until 1857, when he was elected to Congress. He resigned his seat in Congress in 1861 to take part in the secession convention of his state, in the same year was made Postmaster General of the Confederate States, and in 1865 entered the Cabinet of President Davis as Secretary of the Treasury. In 1865, he was taken prisoner and confined in Ft. Warren several months. He took part in the state constitutional convention of 1875, the same year was elected a member of Congress, and served continuously until 1886, when he was elected to the U.S. Senate. In 1891, he resigned his seat in the Senate to become chairman of the Texas State Railroad Commission. He and Sen. Cullom were joint authors of the Interstate Commerce Act of 1887.

Reagent (*re-ā'jent*), a chemical material employed to perform a specific chemical reaction either for the purpose of identification qualitatively, or for determination quantitatively. Reagents may be acids, bases, solutions, gases, or any substance used for a specific reaction. For example, a solution of ammonium oxylate is used as a reagent for the precipitation of calcium as an oxylate.

Real Estate (*rēl ēs-tāt'*), the property which consists of land, tenements, and hereditaments. In law real property does not only consist of land itself, but includes all immovable effects upon it, such as timber, minerals, and buildings. This class of property is distinguished from *personal property*, which consists of movable effects, such as money, furniture, and livestock.

Realism (*re'al-iz'm*), in philosophy, the doctrine which teaches that objects have an existence independent of human perception and cognition. It is opposed to nominalism (*q.v.*), phenomenalism (*q.v.*), and skepticism (*q.v.*). Realistic doctrines have been developed from Greek antiquity through the Middle Ages to the philosophical schools of the 19th and 20th centuries.

In art and literature, realism is the tendency to describe the existing world as nearly true to life as possible without idealization. As in philosophy, this trend can be followed through all the periods of European civilization. It was especially articulate in the last quarter of the 19th century, through writers such as Zola, Ibsen, Hauptmann, etc. (see *Naturalism*), in art through painters such as Corot, Constable, Courbet, Millet, and later the Impressionists (*q.v.*).

Reaper (*rep'ēr*), an implement used for cutting down and gathering grain, as in harvesting

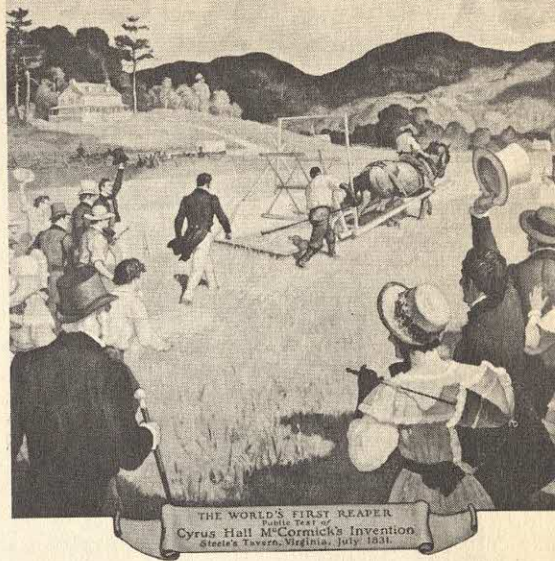
REASON

wheat, oats, or corn. Reaping is as old as human history, the earliest device for cutting grain being the *reaping hook*, or *sickle*, which dates back to the Old Stone Age. Later employed by the ancient Jews and Egyptians, the sickle was used throughout the world down to the latter part of the 19th century. It consisted of a curved blade about 2 ft. long, attached to a wooden handle. Hand reaping began with cutting the grain a handful at a time. This was followed by binding the grain into *sheaves*, which were then combined to form the *shock*. In this way, the grain was left to cure on the open fields until it was ready for threshing. The traditional act of reaping is a significant part of cultural history, as is the familiar sight of grain curing in the sun.

With the mechanization of agriculture brought about by the industrial revolution, hand reaping gave way to the simple, multiple-purpose mechanical reaper. Gradually, the sickle was replaced by the *scythe*, which, in turn, gave way to the *cradle*, and finally to machines drawn by animals. In the U.S., the horse-drawn reaper of Cyrus Hall McCormick (*q.v.*) appeared in 1831. Subsequent improvements resulted in the combined harvester, which performs several tasks in one operation and threshes as it reaps. See *Agriculture; Harvesting Machinery; Mowing Machine*.

Reason (*rē'z'n*), that organ, power, or habit of mind which understands and infers, in contrast with mere sensing or feeling. Both philosophers and psychologists have always distinguished between such higher processes, commonly called "intellectual" or "reflective," and the lower processes of perception and appetite. Man's reason has traditionally set him, the rational animal, above the beasts, and made him kin to the angels and God. Reasoning is considered his own most intimate and autonomous act and yet as grasping most deeply and truly what things are in themselves.

Reason has its charter in logic (*q.v.*), the science of right thinking, which discerns the connections of properties or of propositions, and so enables either proving or explaining some properties or propositions by other properties or propositions. The principles of reason are thus said to be universal, necessary, and *a priori* (independent of sense experience), perhaps innate; but the ideal of reason has naturally changed as interest shifted between the deductive logic of classification, syllogism, and mathematics and the inductive logic of probability and of scientific generalization and hypothesis. It has changed even more as philosophers and psychologists have argued whether reason is a supernal and immaterial agent only incidentally using imagination and calculation, or is a quite mundane analysis of our own meanings or imaginings, or is mere tremors in the throat,



Courtesy International Harvester Co., Chicago

FIRST PUBLIC TEST OF McCORMICK'S REAPER

At Steele's Tavern, Virginia, July 1831

or a shuffling of markers, which last can be done better by computing machines than by men. The *word* reason, however, is mainly associated with the more exalted claims, and the principles of rationalism (*q.v.*) maintain that reason is no mere means of inference, but a direct intuition of absolute reality. Reason, rationalists teach, is superior to the pedestrian "understanding" which creates inductive science and even mathematics. Some persons label reason almost any mode of belief or experience they think has supreme self-evidence or authority, however remote from logic. The haunting question whether reason conflicts with religious faith is thus often confused by calling faith "the highest reason." But the real problem remains: Is religion supported by, or at least compatible with, empirical observation and the logic of deduction and induction? The bearing of reason on moral issues is generally held to be the same as on others, but Aristotle and Kant thought there is a special "practical reason" to show man his duty.

Other uses of reason are derivative. A reasonable (or "rational") man is one whose reason is sound. A reasonable argument, belief, or action is one in accord with reason. That the world is reasonable means that it can be grasped by reason. What is called "a reason" for anything is what makes the thing reasonable in the second or third of these senses. The reason may be what explains the phenomenon, as fire explains smoke (*ratio essendi*, or reason for being), or what confirms belief in it, as fingerprints confirm a suspicion (*ratio cognoscendi*, or reason for knowing), or what justifies action, as nourishment is a reason for eating. Since the reason for a thing's ex-

istence is its cause, reason is often synonymous with cause.

Réaumur (*râ-ô-mür'*), RENÉ ANTOINE FERCHAULT DE, physicist and naturalist, born in La Rochelle, France, Feb. 28, 1683; died in Maine, France, Oct. 17, 1757. Of noble birth, he was educated in La Rochelle and studied mathematics, natural history, and physics. In 1703 he moved to Paris and, in 1708, was elected a member of the Acad. of Sciences. In 1722 he published details of an improved method of producing steel and described the process of tinning iron. He is best known for his invention (1731) of the Réaumur thermometer, which indicates the freezing point of water at zero and the boiling point at 80°. He also invented a type of porcelain which was named for him. In the field of natural history, Réaumur assembled a valuable collection of fossil remains of extinct animals, investigated the regeneration of limbs in crustaceans, and studied the digestive functions of birds. He wrote monographs on many subjects and published an exhaustive "Natural History of Insects" (6 vols., 1734-42).

Rebec (*rê-bêk*), a medieval stringed instrument played with a bow, the European equivalent of the Moslem rebab, and an ancestor of the violin. Made of wood, the rebec was pear-shaped and had from one to three strings.

Rebecca (*rê-bêk'â*), in the Old Testament, the wife of Isaac and the mother of Jacob and Esau (Genesis 22 ff.).

Rebikov (*ryâ-byî-kôf*), VLADIMIR IVANOVICH, composer, born in Krasnoyarsk, Siberia, May 31, 1866; died in Yalta, Crimea, Dec. 1, 1920. Sometimes called the father of Russian modernism, Rebikov studied at the Moscow Conservatory and in Berlin and Vienna. Although his early compositions reflected the influence of Tchaikovsky, he soon found his particular idiom by experimenting with new forms and harmonies. One of the first composers to use the whole-tone scale, he developed many original devices; for instance, in piano and vocal pieces which he called "*Mélomimiques*" he combined music and imitation of nonmusical sounds. He also wrote several orchestral suites, church works, a pantomime, symphonic poems, and operas, including "In the Storm" (1894) and "The Christmas Tree" (1903).

Récamiér (*râ-kâ-myâ'*), MADAME, social leader, born in Lyons, France, Dec. 4, 1777; died in Paris, May 11, 1849. She was born Jeanne Françoise Julie Adélaïde Bernard and was married at 15 to Jacques Récamiér, a wealthy middle-aged banker. Possessing remarkable charm and rare beauty, she presided over a *salon* which was for many years a gathering place for influential political, artistic, and literary figures. Among her friends were Madame de Staël, Benjamin Con-

stant, Sainte-Beuve, and Chateaubriand (*qq.v.*). Because of her friendship for a number of former royalists and other persons hostile to his government, Napoleon I exiled her from Paris in 1811. She returned to Paris in 1814 and retired to a convent in the same year. Madame Récamiér's memoirs and correspondence were published in 1859.

Receiver (*rê-sêv'êr*), a disinterested person appointed by a court to receive and disburse the issues or profits arising from property which is in question through litigation, or which belongs to an infant or to some other person who is not legally competent. The purposes of appointing a receiver are to collect rents or profits, to take charge of and preserve the property from waste or deterioration, and to make final disposition of the goods or property as the court may direct. In some cases such an appointment is made so a business may be conducted, or to prevent the removal of property beyond the jurisdiction of the court. Since the receiver is an officer of the court and is required to give a bond for the faithful discharge of his duties, he is subject to the law and the judicial decree of the tribunal appointing him.

Recessive (*rê-sê's'iv*), in biology, a term describing the gene (*q.v.*) in an allelomorphic (*q.v.*) pair, whose action is obscured by its fellow dominant gene.

Rechabites (*rêk'q-bîts*), in the Old Testament, an ascetic tribe among the Israelites. Believing that contemporary society interfered with the simplicity demanded by the religious life, they refrained from settling in cities, built no houses, and abstained from wine. The tribe, which bore a close resemblance to the Nazarites, was founded by Rechab, whose son, Jehonadab, effected their organization. During Jeremiah's time, the Rechabites resided in Judah and, when Nebuchadnezzar invaded Palestine, they took refuge in Jerusalem (Jeremiah 35; I Chronicles 2:55; II Kings 10:15).

Recife (*râ-sê'jâ*) or PERNAMBUCO, a seaport city in northeastern Brazil, capital of the state of Pernambuco. One of Brazil's most important ports. Recife exports sugar, rum, cotton, lumber, hides, fruit, and coffee. The city lies partly on the mainland and partly on an island, and has a fine harbor enclosed by a coral reef. Sugar refining and cotton milling are the principal industries. Among the interesting buildings are a 17th-century cathedral, the basilica of Our Lady of Carmel, and an old Dutch fort. Recife was first settled (1535) by the Portuguese; from 1630 to 1654 it was controlled by the Dutch. Population, 1950, 522,466.

Reciprocity (*rê-s'î-prô's'î-tî*), in commerce, that policy which encourages mutually advan-

tageous trade relations between two or more countries. As a tariff policy, reciprocity is of relatively recent origin and is generally distinguished from the two extreme commercial systems of protection on the one hand and free trade on the other. Great Britain and the U.S. may, in this connection, be regarded as typical examples; both nations adopted a reciprocity policy at approximately the same time, although approaching the matter from opposing directions. As the home of the Industrial Revolution, Great Britain was long able to compete in the world markets without protection of any kind, and its manufacturers therefore established free trade as a firm national policy. At the end of the 19th century, however, declining markets created a general demand for reciprocity with the rest of the British Empire, to be combined with high tariffs on nonempire products. After more than three decades of dispute, this policy was finally adopted in 1932.

The problems of the U.S. were of a quite different nature. In order to encourage the growth of home industries, the government, almost from the beginning, had maintained a large measure of protection. About the middle of the 19th century a short-lived reciprocal trade agreement was reached with Canada; again at the beginning of the 20th century, Canada was singled out for the renewal of this policy, and again the treaty failed to survive opposition in both countries. When President Franklin D. Roosevelt assumed office in 1933, he attempted to revive the country's foreign trade, which had fallen into a serious decline. The principal instrument of this program was the Trade Agreement Act of June 12, 1934 (extended by Congress thereafter) which empowers the President to negotiate trade treaties with foreign countries in order "to substitute economic cooperation for economic warfare . . . and to create the kind of international economic relations upon which a structure of durable peace can be erected."

The General Agreement on Tariffs and Trade negotiated in Geneva, Switzerland, in 1947, in connection with the International Trade Organization (*q.v.*), extended the Trade Agreements Extension Act under which the U.S. has had reciprocal trade agreements with a number of the negotiating countries. The general provisions of the agreement, incorporating basic rules with regard to nondiscrimination, internal charges and restrictions, quotas and exchange controls, and other measures are not limited to scheduled items but cover the whole of the trade between the parties to the agreement. In 1959 the agreement had been accepted by 37 countries including the U.S.

The General Agreement provides that if, through unforeseen developments, a particular

tariff reduction should increase imports so sharply as to cause or threaten serious injury to domestic producers, the country granting the concession may withdraw or modify it in whole or in part. If the concession is modified or withdrawn, other interested countries may then withdraw or modify substantially equivalent concessions. See also *Tariff*.

Recitative (*rēs-ī-tā-tēv'*), the name of a kind of vocal composition adapted to musical notes, which is midway between ordinary recitation or speaking, which it nearly resembles, and measured air or song. In its early forms, the recitative was used to carry forward the action of an opera. This was particularly so in the first operas (*ca.* 1600) of the Florentine "Camerata." In what these Florentine composers believed to be more or less a reconstruction of Greek drama, they set speech passages to a musical pattern and accompanied it with a bass line which served to keep the singer on pitch. More elaborate accompaniment and more embellishment of this type of "song speech" led to "instrumented" recitative (*recitativo stromentato*) or accompanied recitative, in which the bass was augmented, sometimes to full orchestral strength. The recitative used by Mozart and Rossini in their operas, by Handel in his oratorios and operas, etc., sung simply and with little embellishment, to a minimal accompaniment (chords played by a harpsichord, sometimes joined by stringed instruments), is called "dry" recitative (*recitativo secco*), referring to the manner in which it is sung. It resembles the earlier Florentine recitative. By convention, the recitative was used for narration, dialogue, and other exposition; the aria (*q.v.*) served as comment on the exposition. As the oratorio and opera developed, recitative became more and more indistinguishable from aria, and it is possible to regard Wagner's melodic line as extended recitative, although with elaborate accompaniment. See also *Opera*; *Oratorio*.

Reclamation (*rēk-lā-mā' shūn*), a U.S. program of water-resource development and conservation in the 17 semiarid Western states, authorized by the National Reclamation Act of 1902, approved by President Theodore Roosevelt on June 17 of that year.

Originally conceived to promote the irrigation and settlement of productive Western lands, the reclamation program stresses multiple-purpose water-resource development for control and use of the water resources of the Western states. In addition to providing water supplies for irrigation, reclamation projects provide water for municipal and industrial use, fish and wildlife propagation, public recreation and related purposes, as well as providing large quantities of by-product hydroelectric power and valuable flood-control and navigation benefits.

RECLAMATION

The Bureau of Reclamation, a constituent agency of the U.S. Dept. of the Interior since 1902, and with full bureau status since 1923, has invested more than \$3,000,000,000 in Federal funds in dams, reservoirs, canals, hydropower plants and other physical facilities required for its extensive water-resource conservation and development activities in the 17 Western states and Alaska. These projects are located essentially west of the 97th meridian, which approximately continues the North Dakota-Minnesota line to the Gulf of Mexico.

In most of that vast region, rainfall averages less than 20 in. yearly. Much of the moisture precipitation occurs during the winter as snow deposited in the high mountains. Construction of storage dams to trap and store the runoff of water from the melting snow pack or from heavy rains is essential to provide water for domestic consumption, irrigation, and other uses.

This artificially produced water supply is absolutely essential to agriculture and to municipal and industrial growth, and to the basic economy of the 17-state reclamation area in the West. The principal function of the Bureau of Reclamation is to plan and build water storage and distribution facilities which are beyond the financial means or technical capacity of the respective state and local agencies. Roughly 92 per cent of the Federal funds advanced for this program is reimbursable by the project beneficiaries, with interest on costs allocated to commercial power and municipal and industrial water facilities.

In 1958 crops valued at \$987,000,000 were produced on 6,756,737 acres of irrigated land distributed among 79 projects and units. Crop value per irrigated acre averaged \$146.14 for all projects, with the highest crop value per acre—\$681.70—registered at the Cachuma Project in California.

Since about 1902, the bureau has built or placed under construction a total of 152 multi-purpose storage dams and 113 diversion dams, with a combined reservoir storage capacity of 133,000,000 acre-ft., enough water to cover the entire state of New York to a depth of nearly 4½ ft. Irrigation distribution facilities include 26,005 m. of canals and laterals, and 8,692 m. of drains. Power is produced at 41 hydroelectric plants with an installed generating capacity of 5,100,000 kw. and 9,924 circuit m. of transmission lines.

Two bureau projects were included by the American Society of Civil Engineers in its 1955 list of the seven modern wonders of civil engineering in the U.S.: the 726-ft. Hoover Dam (formerly known as Boulder Dam, *q.v.*), the world's third-highest dam; and Grand Coulee Dam and the entire Columbia Basin Project (south central Washington, about 90 m. west of



Courtesy U.S. Dept. of the Interior

HOOVER DAM AND LAKE MEAD

Dams are important reclamation projects

Spokane), described as an "irrigation marvel." Hoover Dam was the world's highest dam from its completion in 1936 until 1957, when it was topped by Switzerland's 745-ft. Mauvoisin Dam. Vajont Dam in Italy, currently under construction, has been planned to rise to 840 ft. Lake Mead, the 29,827,000-acre-ft. reservoir which was created by the Hoover Dam, was for many years the world's largest man-made lake (now exceeded in capacity by Wainganga Reservoir in India and Kariba Reservoir in Northern Rhodesia).

Grand Coulee Dam is America's largest concrete dam, requiring 10,585,000 cu. yd. of concrete—roughly about two and a half times the quantity required for Hoover Dam. Its two powerhouses contain America's largest hydroelectric plant, which has an installed capacity of 1,974,000 kw. Part of the energy generated is used to power the world's largest irrigation pumping plant.

Each of six pumps already installed is powered by a 65,000-h.p. motor and lifts 12,000 gal. of water per sec. This is enough water to supply the ordinary needs of a city the size of Chicago. When all 12 pumps are installed and working at capacity, they will be able to lift 511,500,000 gal. of water per hr. into the 25-m.-long Grand Coulee, from which it will flow down to irrigate a potential acreage of about 1,000,000 acres—an area larger than the state of Rhode Island.

Since 1936, the Bureau of Reclamation has been building America's longest and one of the world's most complex man-made water systems, the 500-m.-long water-distribution system of the Central Valley Project in California. This integrated system of water storage and conveyance delivers water in river-sized canals to farms and communities in two great river basins—the San Joaquin and Sacramento River valleys—in an area extending from Mt. Shasta on the north to the Tehachapi Mts. in the south.

The project, when completed, will provide water for 1,200,000 acres of valuable diversified farming land, have an ultimate hydroelectric generating capacity of 999,000 kw., and provide substantial flood-control and public recreation benefits.

Water resources of the vast Missouri River

Basin, which embraces more than one-sixth of the surface area of the mid-continental U.S., are being jointly developed by two Federal agencies, the Bureau of Reclamation and the Corps of Engineers. This program, authorized in its initial phases in the Flood Control Act of 1944, provides for ultimate construction of more than 100 reservoirs; 27 hydroelectric power plants, with an installed capacity of 2,500,000 kw.; and irrigation facilities to deliver water to 4,000,000 acres of land.

This is the greatest basinwide water-resource development program in the U.S. and one of the largest in the world. Its objective is to harness an unruly river and transform a drought-plagued, flood-ridden valley into a land of greater economic security, better able to utilize its rich potential of human and physical resources. As the U.S. entered the decade of the 1960s, this complex development program had about reached its half-way mark.

Another impressive basinwide reclamation program was authorized in 1956, a five-state water-resource development in the semiarid Upper Colorado River basin. This \$1,000,000,000 program includes the construction of four major storage reservoirs on the river's main stem, and 11 participating projects on the tributaries to deliver water to basin farms and communities. The storage dams include the 700-ft. Glen Canyon Dam, next in size to Hoover Dam downstream, and destined to be the fourth-highest dam in the world. A man-made lake, 186 m. long and containing 28,000,000 acre-ft. of water, will be created behind Glen Canyon Dam. Project reservoirs will deliver water to many communities and to 346,000 acres of land. One of the projects will make possible water-resource development for the Navaho Indians of New Mexico. Project hydroelectric power plants are planned to generate 1,200,000 kw. of power.

Bureau of Reclamation reservoirs are heavily used for water recreation in the semiarid West. More than 19,000,000 recreational visits were made to the bureau's reservoirs annually in the late 1950's, and bureau projects provided extensive additional benefits to fish and wildlife resources.

The bureau's Denver Engineering Center is world famous for its engineering design and research accomplishments. During the 1950's, more than 1,000 foreign engineers and water-resource technicians and officials spent six months or more in training at the center and on bureau construction projects, under agreements with the U.S. Dept. of State. Former employees of the bureau serve as consultants or staff members in water-conservation planning and development in other countries.

The bureau also maintains a Washington

office and a field staff assigned to seven regions, with headquarters at Boise, Idaho; Sacramento, Calif.; Boulder City, Nev.; Salt Lake City, Utah; Amarillo, Texas; Billings, Mont.; and Denver, Colo. See also *Conservation; Dam; Dust Storms; Irrigation; Soil Conservation; Waterworks.*

Recoil (*rê-kôil'*), the backward kick or jump imparted to a firearm when it is discharged. When a gun is fired, the gases created by the explosion of the powder expand equally in every direction. If the gun and the bullet were of the same weight, the gun would be driven backward with the same speed that the bullet moves forward. However, since the gun is heavier, the backward propulsion is absorbed to a certain extent by the greater inertia of the gun. The remaining force applied backward is what is known as recoil. In large artillery pieces, the heavy recoil is absorbed by hydraulic action. In automatic or semiautomatic weapons, the recoil force is mechanically utilized to operate the loading mechanism. Recoilless weapons operate by allowing a certain amount of the expanding gases to escape rearward through the breech-block, or to escape in sidewise directions (instead of merely forward) from the muzzle, through a slotted device called a muzzle brake.

Reconstruction (*rê-kôn-strûk'shûn*), the term applied to the process of bringing back to the Union the states that seceded before or at the beginning of the Civil War (*q.v.*) in America. The Confederate States passed under the military control of the U.S. when the Confederate army surrendered in 1865, but the states of this federation were regarded as conquered territories and not as members of the Union. President Johnson held the view that these states maintained the same constitutional relation to the U.S. government as before their secession, and accordingly appointed provisional governors. However, Congress upheld the view that these states could be readmitted only on such terms as that body would impose.

President Johnson had recognized provisional governments in all the Southern states before Congress met in December 1865 on their accepting the Thirteenth Amendment to the Constitution. Congress proposed the Fourteenth Amendment to the Constitution and in 1867 passed the Reconstruction Act, by which five military districts were established in the South. The purpose of the act was to effect a registration of voters, including Negroes; these voters were to elect representatives to a convention, which would make a constitution and submit it to be ratified by the people. It was next to be submitted to Congress for approval, and, whenever the Fourteenth Amendment was ratified by the legislature, the states ratifying would be reinstated.

From this act resulted the *carpetbag government*, so called because many designing individuals from the North went South to take advantage of the unsettled economic and political situation. Rendered financially helpless by the war, the leading white men of the South were excluded from active participation in the affairs of government, the debts of the states affected were hugely increased without value returned, and local offices were seriously mismanaged. Many white men, to combat this situation, organized secret societies, such as the Ku Klux Klan (*q.v.*), to prevent the Negroes from voting or holding public offices. In 1872 Congress passed the Amnesty Act, which removed the disqualification of the ex-Confederates. The Reconstruction period ended in the administration of President Rutherford B. Hayes (*q.v.*), who withdrew the Federal troops.

Reconstruction Finance Corporation (*fī-nāns' kôr-pô-rā'shūn*), a Federal agency, created by Act of Congress, Jan. 22, 1932, and abolished as of June 30, 1957, after having been placed in liquidation in September 1953. Originally its management was vested in a five-member board of directors, but in May 1951 the board was abolished and its functions were transferred to a single administrator, appointed by the President with the advice and consent of the Senate. A deputy administrator was also provided. During its lifetime, the functions of the corporation were both extended and modified by legislation. The term of the corporation, originally established at ten years, was subsequently extended by Congress until June 30, 1956, with its lending powers scheduled to terminate on June 30, 1954. The

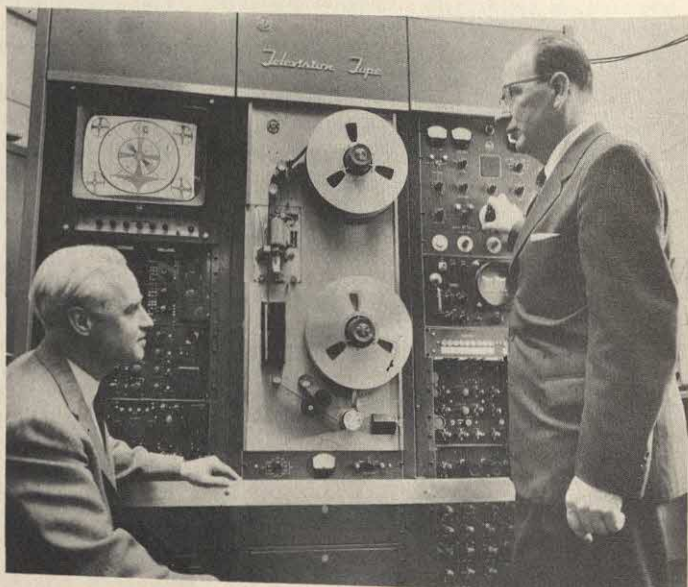
capital stock of the agency, originally fixed at \$500,000,000, was later reduced to \$100,000,000. The corporation made loans to public agencies, business enterprises (especially small business), financial institutions, insurance companies, railroads, mining interests, and other classes of borrowers. It was authorized to purchase the capital stock of banks, insurance companies, agricultural credit corporations, national mortgage associations, and various governmental agencies. The corporation, directly or through subsidiaries, played a major role during World War II. It made loans to manufacturers to enable them to complete war contracts, built plants and facilities for the manufacture of matériel, procured supplies and equipment, bought critical and strategic materials, and wrote war-damage insurance. The corporation's function as a disposal agency for surplus capital and producers' and consumers' goods was transferred in March 1946 to the War Assets Admin.'

Record (*rĕk'ĕrd*), a written memorial or account of a fact or event of public interest, made by a public official and preserved for future reference. Records may be either public or private; the care of public records is provided for by law. Public records may be classed as *judicial*, *legislative*, or *miscellaneous*. Both the books and the original paper pertaining to a cause at law are legal records. See also *Document*; *Domesday Book*.

Recording (*rĕ-kôrd'ing*), the process of preserving sounds, pictures, or data in reusable form. The earliest and perhaps most familiar device for this purpose is the phonograph (*q.v.*). Aside from phonographic recording, the term is

TV TAPE RECORDER

Tape-recording equipment such as the model shown here has made possible enormous improvements in the quality of television programs. The 14-in. reel (*upper center*) accommodates up to 96 minutes of recorded black-and-white or color programming with the visual quality of "live" performances (courtesy Radio Corporation of America)



specifically applied to the preservation and reproduction of material by electronic devices without the intervention of light or lenses (e.g., film projectors, microfilm readers) or of mechanical pickups (e.g., phonograph needles).

Most recording is now done by means of plastic tape coated with iron oxide, which is run through machines called tape recorders. In the simplest form, the household recorder or office dictating machine, sound is picked up by a microphone or by direct connection to a phonograph or radio. Electronic tubes or transistors translate the sound into electromagnetic impulses, which are imprinted on the tape as it passes over a "recording head." These remain on the tape until such time as they may later be "erased" by another electromagnetic device. When the tape is subsequently passed, at the same speed at which the recording was made, over a "playback head," the magnetic impulses are electronically retranslated into sound through an amplifier. The more complex machines merely elaborate upon this basic principle.

Tape recorders may be small enough for a businessman or interviewer to carry in a briefcase, or even in a pocket, or large enough to handle 24 hr. of program material for a broadcasting station. They are extremely useful for keeping word-for-word transcripts of exactly what has been said in an interview or business meeting. Sound recorders are widely used in radio broadcasting for advance preparation of program material and commercial announcements, and for on-the-spot transcription of news events. The phonograph-record industry uses taped material for the cutting of lacquer disks; tape has the advantage that it can be edited (cut and spliced) at will. The motion-picture industry uses recorders to capture the sound-track portion of films. For television, tape recorders convert both sound and picture signals (in either black-and-white or color) into tracks on magnetic tape for either immediate or later playback. Taped television material approximates the picture quality of "live" programing more closely than does motion-picture film, and it has the advantage of immediate availability (i.e., does not have to go through the development processes of film).

Magnetic tape is becoming increasingly important in electronic processing of data. Facts and figures previously tucked away on bulky paper in filing cabinets are now recorded on reels of magnetic tape with the help of electronic computers. This system not only saves filing space but, by coding systems, makes vast amounts of data immediately available. Nonbusiness computers are used to guide and track the missiles of the space age as well as to record on magnetic tape their successes and failures.

The specific advantages of tape recording are the saving of filing space, the ease with which tapes may be edited, and the fact that the tapes, while subject to mechanical contact (with recording and reproduction heads), are not subject to wear from phonograph-needle contact or to heat (as in projection machines), so that there is no marring of their reproduction surfaces; their fidelity and accuracy are therefore much more permanent than those of phonograph records or film.

Recreation (*rĕk-rĕ-ă'shŭn*), pleasurable activity outside a person's daily work or duties. Recreation, a boon to bodily and mental health, may take the form of athletics, arts, crafts, music, drama, social activities, creative expression, or amusements. As a spectator, or preferably as an active participant, the average person has much to gain from recreational activities. Some persons are capable of conducting such a program individually, but most people are able to enjoy a rich and satisfying leisure only if recreational opportunities are provided by community agencies. Factors leading to an increase of recreational facilities on the part of government, education, church, business, and industry have been: gradual decrease of working hours; wider employment of women (including mothers); livelier interest in sports and organized entertainment; social problems including juvenile delinquency; overcrowded living conditions; and the recognition of the importance of recreation as a means of self-expression. Today the provision of recreational facilities and programs for the public is the concern of local, state, and Federal administrations, of philanthropy, and of social welfare organizations.

Recreation, formerly on a simple home scale, has been aggrandized by the introduction of the automobile, motion picture, radio, and countless other inventions affecting everyday life, so that it now covers a tremendous field. It has become an integral part of the American scene. If properly planned and directed by trained leaders, recreational activity can serve to combat social ills, such as juvenile delinquency (*q.v.*), and to promote the nation's health. Recreation for the public requires expenditures for facilities, leadership, and programs in order to assure satisfying diversion to all children and adults.

Increasing emphasis is placed on outdoor recreational areas and facilities. Public parks have become play centers rather than restricted horticultural exhibits. The municipal recreation system includes such features as bandstands for outdoor concerts, stadiums, playfields, neighborhood playgrounds, swimming pools, dance pavilions, golf courses, tennis courts, gymnasiums, auditoriums, museums, and winter sports facilities.

Schools are meeting the greater need for rec-

recreation by providing playgrounds and by instruction in games and sports, arts and crafts, music, and other activities that can be enjoyed in leisure time. Clubs organized around a specific recreational interest, such as nature study, hiking, sewing, reading, bicycling, etc., abound in modern schools and colleges.

Organized sports cater to the important problem of leisure activity. Community centers, Young Men's and Young Women's Christian and Hebrew Assn. buildings, industries, churches, and numerous other youth-serving organizations offer indoor and outdoor recreation.

The role of recreation in wholesome human living was recognized by the armed forces during World War II. Vast sums were expended for recreation facilities and equipment. In communities, varied services were rendered by such organizations as the U.S.O.

An undeniable thread of our social fabric, planned recreation calls for a well-balanced program, integrating private, municipal, county, state, and Federal efforts. It requires ample funds, wide cooperation, and intelligent organization and administration. For more than 40 years guidance and leadership in the field have been rendered by the National Recreation Assn.

Rectangle (*rĕk'tāng-g'l*), a parallelogram having all of its angles right angles. The area of a rectangle is equal to bh , where b is the length of the base and h is the altitude. A rectangle having all of its sides equal is called a square. A diagonal of a rectangle divides it into two congruent right triangles. The two diagonals of a rectangle are equal and bisect each other.

Rectification (*rĕk-tī-fī-kā'shūn*), a term used in the distilling industry for the purification of crude spirits. Two methods of rectification are practiced. The first method is the redistillation of spirits, this term being applicable to any redistillation, whether of alcohol or other substance. To avoid confusion, rectification by distillation is termed *fractionation* or *fractional distillation*. The second method is one of blending, usually by filtration through bone char or activated charcoal.

Alcohol obtained from inexpensive sources, such as molasses, mixed with grain whiskey, would place pure grain whiskey at a competitive disadvantage. Therefore an equalization tax, called a *rectifying tax*, is placed on whiskey blended with raw alcohol.

In electricity, rectification is the process of converting an alternating current into a unidirectional current by means of a rectifier (*q.v.*). If the rectifier uses only half of the alternating current wave, it is called single-wave, but, if it uses both halves of the wave, it is called full-wave. Since the rectified current is pulsating, a filter is frequently employed to smooth the fluctuations.

Rectifier (*rĕk'tī-fī-ĕr*), in electricity, a static device used for converting alternating current (*q.v.*) into unidirectional or direct current (*q.v.*) by means of electrical conduction. Such a device permits the passage of an electric current in one direction only, just as a check valve in a water system permits water to flow in only one direction.

Developments and improvements in rectifiers and rectifier circuits in recent years have made them of increasing importance in industrial electrical systems, and in many uses they have now supplanted rotating equipment (see *Converter*).

Static rectifiers are widely used in radios, in charging storage batteries, and in electrochemical processes, all of which uses require direct current. There are several types, including the following: (1) Thermionic vacuum tube (*q.v.*), with hot (two-element) cathode and gaseous conduction. Some of these use mercury vapor (e.g., "Tungar," "Phanotron"). (2) Thermionic vacuum tube with hot (three-element) cathode, in which a grid is introduced as the third element for control ("Thyratron"). (3) Mercury-arc tube with cold (pool-type) cathode and gaseous conduction. (4) Dry-disk tube, in which unilateral conduction takes place at a junction between a copper disk and a layer of cuprous oxide. These may be said to be the principal types; but any device which permits the passage of current in only one direction may be used as a rectifier.

Rectum (*rĕk'tūm*), in anatomy, the lowest part of the intestine, situated within the pelvis and ending in the anus.

Red (*rĕd*), one of the three primary colors, seen at the end of the spectrum, owing to the fact that its rays are the least broken or refrangible. Red pigments or coloring matters are obtained from the mineral, animal, and vegetable kingdoms. Vermilion and the red ochers come from mineral sources, carmine and scarlet from animal sources, and madder pigments from vegetable sources.

Red Bank (*rĕd bāŋk*), a borough in Monmouth County, New Jersey, ca. 40 m. s.w. of New York City. Situated on the Navesink River, it is served by the Pennsylvania and the Central of New Jersey R.R.'s. Red Bank produces washing machines, uniforms, cosmetics, and drugs. Clay and gravel deposits, potato farms, and apple orchards are in the vicinity. Just east of Red Bank is part of the famous New Jersey shore resort area, and the borough is the site of summer and winter sports events. Red Bank was settled in 1650 and incorporated in 1872. Population, 1940, 10,974; in 1950, 12,743.

Redbreast (*rĕd'brĕst*). See *Robin*.

Red Cloud (*rĕd klowd*), popular name of MAQPEYA-LUTA, a chief of the Oglala Sioux, born near Blue Creek, Nebr., 1822; died in Pine Ridge, S.D., Dec. 10, 1909. He was noted at an early

age for bravery upon the warpath and wisdom in council. In 1863 he fought against the Federal government and remained hostile for five years. He joined Sitting Bull in opposing the sale of the Black Hills and the surrender of their possessions in South Dakota and Wyoming. In 1890 he joined in celebrating the ghost dance. He was several times a delegate to Washington, D.C.

Redcoats (*rēdkōts*), popular name for the British soldiers during the American Revolution, derived from the color of their military uniforms.

Red Cross (*rēd krōss*), AMERICAN, one of a number of national societies organized for the relief of the sick and wounded in time of war, and for other purposes. The Treaty of Geneva, under which Red Cross societies operate, originated as a result of the efforts of Henri Dunant, a Swiss noncombatant who witnessed the battle of Solferino in 1859 and, horrified at the suffering of the wounded, organized the villagers of surrounding communities into volunteer groups to give assistance after the fighting had ceased.

At the close of the war he published his impressions of the event, "Un Souvenir de Solferino," in which he vividly described the suffering of the sick and wounded left on the field of carnage and called for a world conference to "found and organize in all civilized countries permanent societies of volunteers which in time of war would render aid to the wounded without distinction of nationality." In the third edition of his booklet, published in 1863, he advanced the thought that such societies might also be of great service during epidemics or in disasters such as floods and fires.

Following through, Dunant visited many

European countries in order to win support for his ideas. The result was an exploratory conference held in Geneva in 1863 and attended by 36 representatives of 16 nations. Dunant's suggestions were favorably received and the conference proposed an agreement between the nations embodying the newly advanced principles.

In 1864, at the invitation of the Federal Council of Switzerland, a convention was held in Geneva, the outcome of which was the Treaty of Geneva or Geneva Convention, based substantially upon the recommendations made the previous year. It set forth the principles that wounded soldiers were to be respected; military hospitals were to be regarded as neutral; personnel and material of the medical services were to be protected; and the symbol of this protection was to be the red cross. In 1906 protection for volunteer aid societies sanctioned by their governments was included in the treaty, and in 1929 standards were established for treatment of prisoners of war; the latter were granted mail and parcel post privileges, and provision was made for inspection of prisoner-of-war camps.

Under the Treaty of Geneva, the International Red Cross Committee operates to see that signatories abide by its provisions. Composed entirely of Swiss citizens, the committee during World War II directed and supervised distribution of 431,862 tons of supplies such as food parcels, medicine, and clothing for prisoners of war. It was in charge of the reforwarding of all mail between prisoners of war and their families. The International Committee, along with the national Red Cross societies, provided a system of communication between free civilians living in countries at war with each other and in this capacity handled more than 23,000,000 messages. During the war the committee maintained 56 delegations, composed of 320 delegates, who inspected 4,450 prisoner-of-war camps. For its work on behalf of prisoners of war in 1944 the International Committee was awarded the Nobel Peace Prize in November 1945.

The League of Red Cross Societies, a separate organization from the International Committee, was founded in 1919 and works in close cooperation with the latter. The league's function is primarily to co-ordinate peacetime activities of national Red Cross societies throughout the world, particularly as they affect disaster relief, education, health, Junior Red Cross, and similar matters. The league is also interested in strengthening national societies and rebuilding those disrupted by war. American Red Cross Chairman Basil O'Connor was elected chairman of the Board of Governors of the league for a four-year term at the organization's first postwar meeting, Nov. 14-16, 1945, in Paris.

Under the leadership of Clara Barton, who

HENRI DUNANT

Founder of the Red Cross Society

Courtesy American Red Cross



served as its first president, the American Red Cross was founded in 1881 with permanent headquarters at Washington, D.C. The U.S. ratified the Treaty of Geneva the following year. Expansion of the society's work led to a complete reorganization in 1905, when the Red Cross was granted the congressional charter under which it now operates. This charges it with the obligation of furnishing aid to sick and wounded in time of war, acting in matters of voluntary relief, maintaining communication between the people and their armed forces, and carrying on a system of national and international relief in time of peace, to prevent or mitigate the suffering caused by pestilence, famine, fire, floods, and other national calamities.

In its early years, the American National Red Cross drew wide public acclaim by its prompt action in disasters both at home and abroad. During World War I, the organization expanded, the number of chapters increasing from 560 to 3,700, while membership rose from 500,000 to 20,000,000. During this period it collected and spent approximately \$400,000,000 for relief and services. The American Red Cross provided a number of fully equipped hospital units, staffed with surgeons and nurses. At about this time, too, the Red Cross undertook its welfare activities among personnel of the armed forces: representatives were attached to units sent into Germany and Siberia; assistance was extended to families of servicemen in matters of comfort, business difficulty, illness, etc. Co-operating with the International Red Cross Committee, food and clothing were sent to prisoners of war, and badly wounded men were exchanged. During and after the war, the problem of refugees and other civilian war victims became acute. Acting in co-operation with the government agencies at home and abroad, the Red Cross provided food, clothing, shelter, medical care and employment to millions of refugees; nearly 2,000,000 were aided in France alone.

President Wilson, by proclamation in September 1917, created the American Junior Red Cross in which 8,000,000 boys and girls were shortly enrolled. By their handicraft and labor they contributed millions of articles, such as canes, splints, and furniture, for use by the armed forces.

Following World War I, the American Red Cross entered a period of expansion of its normal, peacetime activities. Widespread floods in the Ohio and Mississippi Valleys and elsewhere, and other serious disasters, called its relief workers into action repeatedly. Educational and health services were strengthened. The Red Cross also assisted in administering government distribution of certain surplus commodities during the drouth years in the early 30s. With 4,000,000 veterans of World War I, assistance to these men

and their families and dependents was a continuing and important responsibility.

With the outbreak of World War II, the Red Cross was once more called upon to expand its vital services. The American Red Cross provided relief in the form of food, clothing, and medical supplies to millions of civilian war victims in Poland, Russia, Finland, Norway, Holland, Belgium, France, England, and other countries. The Red Cross acted as official recruiting agent for Army and Navy Nurse Corps personnel. Aided by the Junior Red Cross, the adult organization made and distributed millions of comfort and recreation articles. Clubs, canteens, hospital motion-picture theaters and recreation centers, along with assistance in personal and family problems, helped the men and women in the services to overcome or forget their problems. More than 13,000,000 pints of blood were collected for the armed forces and processed into life-saving plasma and other products. All other welfare activities begun in previous wars were resumed on a larger scale. More than 4,000,000 volunteer workers in the U.S. assisted in this work. A generous American public responded to the Red Cross appeals for funds by contributing \$666,510,388 during the war years.

With the change-over from war to peace, the American Red Cross prepared to continue its peacetime activities on an expanded basis. Health and educational services were reorganized. A civilian blood-donor service was established. Work on behalf of veterans in hospitals was expanded. Chapter home service, which assists the families of servicemen as well as veterans and their families in meeting personal and family problems, was enlarged so that it might better cope with increasing demands. Disaster preparedness and relief committees in chapters were strengthened.

Redemption (*rě-děmp'shūn*), a theological term expressing the idea that individual man, being born in sin, must be redeemed and that the means of his redeeming will be provided by the Deity. This idea is not limited at Christianity, but is shared by all highly developed religions. To mention only one non-Christian example, the Buddhist conceives redemption to be a final goal to be reached by successive reincarnations and rebirths. The more he has succeeded in suppressing his natural cravings in one life, the higher will be the level on which he will be reborn. He reaches his final salvation after he has succeeded in suppressing all human activities, which, to the Buddhist, always mean pain. This salvation is conceived of as complete nonexistence in personal form (see *Buddhism*).

Redemption in the Western world is always associated with the specific Christian idea of redemption. Although the Old Testament already

speaks of the possibility of redeeming, there it is a payment of money or a punishment which grants redemption, and redemption is not conceived of as spiritual but as a mere physical redemption from evil in this world. National redemption of the Jews meant deliverance first from Egypt and later on from Babylon, and for these purposes God is the Redeemer.

The general concept of Christ is that of a personal Redeemer. His sacrificial death is the redeeming payment, the ransom. Theological interpretations of how far this payment goes vary, however, from that which believes Christ's sacrifice has redeemed only the individual man from sin and sin's punishment to that which believes that He redeemed the whole world from evil. In the latter form, when the whole world will be purged and healed, the idea approaches the Jewish concept of redemption through the Messiah. Originally, Christian redemption was interpreted as a payment to the devil, who through original sin held his hold on man. Later usage of the word saw it as a payment to God in order to make good what man had failed through his sin. Finally, redemption was thought of as the ultimate hope of man, but beyond his personal power to reach. Instead of that, Christ paid by His death and thus salvation was offered to man. How conclusive this offer, spontaneous and open to all men, is, remains the great theological problem of all Protestant theology. The great questions are whether grace exists, and whether everyone can participate in it or whether one must do something to deserve it, and whether or not there is actually an assurance of salvation. The Catholic doctrine has always answered that faith in the creeds and the teaching of the Church is the decisive factor for salvation, but not all Protestant creeds share this belief. See also *Predestination*.

Redfish (*rĕd'fĭsh*), the name of several fishes, found chiefly off the southern coast of the U.S. and in the waters off the coast of California and Lower California. One of the species is the familiar *red drum*, or *channel bass*, which has a grayish red color and is from 3 to 5 ft. long. It is caught in the Gulf of Mexico as a food fish. A species frequently called *flathead* is abundant in California.

Red Jacket (*rĕd jăk'ĕt*), an Indian chief of the Senecas, born near Lake Seneca, New York, in 1752; died on the Seneca reservation near Buffalo, Jan. 30, 1830. His Indian name was Sagoyewatha, meaning "He keeps them awake," but he was named Red Jacket from a scarlet jacket presented to him early in the Revolution by a British officer. He fought with the Six Nations against the colonists during the Revolution, but helped the Americans against Tecumseh in 1809-10, and fought against the British in the War

of 1812. He lost his position as chief for a time after retiring to the reservation on account of intemperate habits, but was afterward reinstated. Red Jacket was sagacious as a statesman and eloquent as an orator, but persistently opposed the establishment of Christian missions and schools. He was the last chief of his tribe, and is therefore sometimes called "the last of the Senecas."

Redlands (*rĕd'lăndz*), a city in San Bernardino County, Cal., at the foot of the San Bernardino Mts., 68 m. E. of Los Angeles. It is the center of the largest navel orange plantings in the world. There is a community concert bowl and the chief buildings include the Univ. of Redlands, Smiley Public Library, the Lincoln memorial shrine, and several fine churches. It was settled in 1881 and incorporated in 1888. Population, 1940, 14,324; in 1950, 18,429.

Red Men (*rĕd mĕn*), IMPROVED ORDER OF, a patriotic, fraternal, and beneficial organization, first chartered by an act of legislation in Baltimore, Md., on Mar. 14, 1834. The members forming the order came from the patriotic fraternal orders first instituted about 1765 in Boston, then known as the Sons of Liberty and Sons of St. Tammany Society. In 1813 the Society of Red Men was formed at Ft. Mifflin, in Pennsylvania. This later became the *Improved Order of Red Men*, adding the beneficial to the patriotic and fraternal elements. The council fire of the first session of the Great Council of the U.S. (national body) was kindled in Baltimore in 1847 under a charter granted by the Commonwealth of Pennsylvania. The Improved Order of Red Men now operates under a congressional charter approved Apr. 17, 1906.

Three degrees are conferred: those of adoption, warrior, and chiefs. The chiefs (officers) are named after officials among the Indians, such as prophet, sachem, senior sagamore, junior sagamore, chief of records, and keeper of wampum. The order has a membership of about 200,000, which includes the auxiliary (female) Degree of Pocahontas. The motto is "Freedom, Friendship, and Charity."

Redmond (*rĕd'mŭnd*), JOHN EDWARD, statesman, born in Dublin, Ireland, in 1856; died Mar. 6, 1918. He studied at Trinity Coll., Dublin, was admitted to the bar and became a member of parliament, representing New Rose until 1885, when he was elected for North Wexford. In 1900 he became the leader of the Nationalist party, in which he continued active for Home Rule until his death. He declined the honor of holding a position in the coalition cabinet of 1915.

Red River (*rĕd rĭv'ĕr*), an important western tributary of the Mississippi, the most southerly affluent of that river. It rises in the Staked Plain in Texas, near the boundary of New Mexico. It receives the water from the Negro, Washita, and

Little Washita Rivers. Owing to its winding course, the Red River has a length of 1,550 m., of which about 1,200 m. are navigable. It was so named from the color of the sediments carried by it in a period of high water.

Red River, or *SONG-KOI*, a river of French Indo-China, in Tonking, rising in the highlands of southern China. After a course of 650 m. toward the southeast, it discharges through a delta into the Gulf of Tonking. In its course are several rapids. On its banks is the city of Hanoi, the capital of Tonking.

Red River of the North, a river of the U.S. and Canada, forming the principal part of the boundary between Minnesota and North Dakota. The Otter Tail rises in the lake region of western Minnesota, near the source of the Mississippi, and has a general course toward the southwest until it makes a bold curve near the border of the state and then joins the Bois de Sioux to form the Red River of the North, which flows nearly due north into Lake Winnipeg. Among its numerous tributaries in the U.S. are the Goose, Sheyenne, Wild Rice, Marsh, and Red Lake Rivers. Its total length is 660 m., of which 520 m. are in the U.S. The Assiniboine joins it in Manitoba, at the city of Winnipeg. The Earl of Selkirk made the famous Red River settlement, on the banks of the Red River of the North, in 1812. It was founded on a tract of land obtained from the Hudson Bay Co., which was afterward conveyed back to that company, and in 1870 was transferred to Canada. It is now a part of the province of Manitoba.

Red Sea (*rēd sē*), or ARABIAN GULF, an inlet from the Indian Ocean, lying between Africa and Arabia. It communicates with the Gulf of Aden by the Strait of Bab-el-Mandeb, and stretches in a narrow expanse of water toward the northwest to the Isthmus of Suez, which separates it from the Mediterranean. Its length is 1,450 m. and its width in the central part is about 200 m., whence it gradually diminishes toward the extremities, being about 20 m. wide near the Strait of Bab-el-Mandeb. It is divided in the upper part by the Sinai Peninsula, thus forming the two gulfs of Suez and Akabah. The former is the larger of the two, being 180 m. long and 25 m. wide, while the latter is 100 m. long and about 12 m. wide. The Red Sea has been an important seat of commerce from remote antiquity and was navigated by the ancient Egyptians, Phoenicians, Arabs, Hebrews, and Persians.

Navigation of the Red Sea is more or less dangerous, owing to the prevalence of violent winds and the numerous shoals, islands, and coral reefs that abound along the shores. Coral reefs are particularly abundant near the Arabian coast, where they are remarkable for their scarlet tints mingled with white. A strong current of wind

blows from the south from October to May, and from the north from May to October. This results in a current of water passing through the Strait of Bab-el-Mandeb in the former season, which raises the sea level several feet, but it is correspondingly lowered in the period in which the wind blows from the north. Much of the trade from Southern Asia passed up the Red Sea and was conveyed by caravans to the Mediterranean until the route around the Cape of Good Hope was discovered, when it was turned largely in that direction, but in 1870 the Suez Canal was opened to trade, which immediately re-established the Red Sea as an important highway between the Orient and the Occident. Considerable trade is carried across the sea, but this consists chiefly of local products and the traffic in connection with pilgrims to Mecca. Jeddah, Hodeida, and Mocha are the principal seaports on the Arabian coast and Kosseir, Massowa, Suez, and Suakim on the African coast.

Red Spider (*rēd spī'dēr*), or SPINNING MITE, a type of Acardia or Acarina, a parasite which causes the leaves of plants to turn yellow.

Redstart (*rēd'stārt*), a genus of American birds which are native to a region extending from Canada to Bolivia. About a dozen species have been described. They are very active, being skilled in catching flies and other insects while on the wing. The male of most species has a glossy black color, with spots of white and orange red on the wings and tail, and the female is brownish. The common redstart of the Old World is somewhat larger and resembles the redbreast. It has a melodious song and may be domesticated. Redstarts are migratory.

Redtop (*rēd'tōp*), the name of several species of grass grown extensively for hay and pasture. It is sown in most localities with timothy and clover and thrives best in soils that are too moist for the growth of other cultivated grasses. All the species are valuable because they maintain themselves against the growth of weeds and other grasses of less value. Some species are small and are sown to decorate lawns and parks.

Red Wing (*rēd wīng*), county seat of Goodhue County, Minnesota, on the Mississippi River, 40 m. S.E. of St. Paul. It is on the Chicago Great Western and the Chicago, Milwaukee, St. Paul & Pacific R.R.'s. The noteworthy buildings include the county courthouse, the Sheldon Memorial Auditorium, and the postoffice. Manufactures include shoes, furniture, lumber products, machinery, plate glass, stoneware, flour, and earthenware. The surrounding country is agricultural and dairying. Red Wing was settled in 1853 and incorporated as a city in 1857. Population, 1940, 9,962; in 1950, 10,645.

Red-Winged Blackbird (*rēd'wīng'd blāk'bird*), a small black bird with a red-colored patch

on each shoulder, native to the East and Middle West of the U.S.

Redwood (*rēd'wōd*), a species of sequoia, native to the Pacific coast of North America, but found chiefly in Oregon and California. It is one of the largest trees in existence, attaining a diameter of 12 to 15 ft. and a height of 225 to 300 ft. The name redwood is applied because the newly cut wood has a reddish color, but it soon fades on exposure to light and the air. The grain of the wood is straight, is well fitted for inside finishing of buildings, and takes a good polish. The forests are maintained by seeds and suckers sent up from the stumps. See *Sequoia*.

Reece (*rēs*), B(RAZILLA) CARROLL, politician, born in Butler, Tenn., Dec. 22, 1889; died in Bethesda, Md., March 19, 1961. A member of the Republican party, he served 18 terms as a Congressman from Tennessee (1921-31, 1933-61); he was succeeded by his widow, Louise Goff Reece. He was also chairman (1946-49) of the Republican National Committee.

Reed (*rēd*), in music, the mouthpiece of the bassoon, hautboy, clarinet, and several other instruments. Reeds were first made of cane, whence the name has been extended to the reeds of the organ and the harmonium, which are now made of a thin strip of metal. The reed itself does not produce the sound, but is only the means of obtaining the sound from the current of air directed against it. Two classes of reeds are in general use, the striking and the free. The *striking reed* is commonly used in the pipes of an organ and requires to be placed in a tube as a means to produce a musical sound. The *free reed*, such as is used in the harmonium, has a smoother and more mellow sound than the striking reed and does not require a pipe, as does the latter.

Reed, JAMES A., politician, born near Mansfield, O., Nov. 6, 1861; died Sept. 8, 1944. His parents moved to Linn County, Iowa, in 1864. He practiced law in Cedar Rapids for two years and then moved to Kansas City, Mo., where he became actively identified with local and state politics as a Democrat. In 1898 he was elected prosecuting attorney for Jackson County, Missouri, serving until 1900. He was mayor of Kansas City for two terms, from 1900 to 1904. He was U.S. Senator from Missouri, 1911-29.

As Senator, he opposed American entrance into the League of Nations, the permanent Court of International Justice, and the Volstead Act.

Reed, STANLEY FORMAN, jurist, born Dec. 31, 1884, in Mason County, Kentucky. He studied at Kentucky Wesleyan Coll., Yale Univ., the Univ. of Virginia, Columbia, and the Sorbonne. After his return to the U.S., he was admitted to the Kentucky bar in 1910 and began to practice in Maysville. He was a Democratic representative in the Kentucky legislature from 1912-16. He served

as general counsel for the Federal Farm Board from 1929-32, in the same position for the Reconstruction Finance Corp. from 1932-35, and as Solicitor General of the U.S. from 1935-38. As Solicitor General he presented to the U.S. Supreme Court, among other cases, those which tested the constitutionality of the NRA, the AAA, the Wagner Labor Relations Act, and the TVA. He became an Associate Justice of the Supreme Court in 1938, usually voting with the liberal members of that bench.

Reed, THOMAS BRACKETT, Congressman, born in Portland, Me., Oct. 18, 1839; died Dec. 6, 1902. He was graduated from Bowdoin Coll. in 1860, studied law, and in 1864 entered the navy as assistant paymaster. In 1865 he began the practice of law at Portland and in 1868 became a member of the Maine legislature. He was attorney general of the state for two years, was city solicitor of Portland for four years, and in 1876 was elected as a Republican to Congress, where he served continuously until retiring from political life on Apr. 20, 1899. Reed became a leader of his party on the floor of the House soon after entering Congress, and served as Speaker of the House in the 51st, 54th, and 55th Congresses. He is the author of Reed's "Rules of Parliamentary Law" and contributed many articles to magazines and encyclopedias.

Reed, WALTER, army surgeon, bacteriologist, born in Belroi, Va., in 1851; died in 1902. After being graduated from the Univ. of Virginia (1869) and continuing his studies at Bellevue Hospital, he entered the medical service of the U.S. Army. He served on the frontier for 15 years, then instructed in bacteriology at the Army Medical School at Washington and acted as curator of the Medical Museum there. In 1900, he

WALTER REED

U. S. Army Signal Corps Photo



headed a commission to determine the cause and transmission method of yellow fever in Havana. His discoveries made it possible to wipe out the disease by destroying the species of mosquito that carried it. Walter Reed Hospital in Washington commemorates his work, which included studies of typhoid, erysipelas, and cholera.

Reese (*rēs*), LIZETTE WOODWORTH, writer, born in Baltimore County, Maryland, in 1856; died in 1935. She wrote a quantity of romantic verse and autobiography, notable examples of which include: "A Handful of Lavender" (1891), "Way-side Lute" (1909), "Spicewood" (1920), "White April" (1930), and "Pastures" (1933). Her work is represented in most American anthologies.

Reeve (*rēv*), ARTHUR BENJAMIN, author, born at Patchogue, N.Y., Oct. 15, 1880; died Aug. 9, 1936. He was graduated from Princeton Univ. and became assistant editor of *Public Opinion* and later editor of *Our Own Times*. His books are humorous, and many revolve around a character named *Craig Kennedy*, a detective who (for his times) pioneered in the use of scientific devices as weapons against crime, e.g., the microphone, the portable wireless, etc.

Referendum (*rĕf-ĕr-ĕn'dūm*), the name for the practice of submitting to a vote of the people for approval or rejection the laws passed by their representatives in a legislative capacity. Such laws are first passed by the legislature and properly certified, and they are then submitted at the next regular election for consideration by the electorate. In some countries the referendum is *optional*, while in others it is *obligatory*, that is, the laws must be submitted without petition. The *initiative* is the logical complement of the referendum, since it enables the people to draw up their own laws, which are then submitted to the legislature, or they may be proposed by petition and submitted without any action on the part of the legislative branch. Both the initiative and the referendum are in use in some form in all the cantons of Switzerland, except Freiburg. Both are in vogue as a feature of the government of the Swiss Confederation, and under a provision of the constitution it is obligatory to submit any law on demand of eight cantons, or a petition signed by 30,000 citizens. The referendum was adopted in Switzerland in 1874 and the initiative in 1891. In Canada and the U.S. the referendum is employed to some extent in matters of municipal and state government. See also *Election*.

Reflection (*rĕ-flĕk'shūn*), the power that the mind has to consider and compare sensations and ideas by the aid of the principles of association. It is one of the primary sources of all ideas, the other source being *sensation*. Some writers, as Herbart, discuss analysis and synthesis as integral parts of reflection.

Reflector (*rĕ-flĕk'tōr*), an apparatus for controlling the direction of travel of light. Reflectors differ from mirrors in that no image is formed. The searchlight reflector is paraboloidal in shape with the light mounted at the focus of the paraboloid. Searchlight reflectors used by the U.S. Army for spotting airplanes have a range of as far as 5½ m. away. The French physicist, Augustin Fresnel (1788-1827), devised a lighthouse reflector using right-angle prisms to reflect the light in order to prevent loss in the vertical direction.

Reflex Action (*rĕ'flĕks āk'shūn*), any action performed involuntarily in consequence of an impulse transmitted along certain nerves to a nerve center. The impulse is reflected to an efferent nerve, inducing action in certain muscles, organs, or cells. Reflex action has its seat chiefly in the brain and spinal cord. The majority of these phenomena are complicated, varying greatly in the intensity and rapidity, as in a series of coughs to remove dust from the air passages. Extensive research has shown that the impulses from the receiving surface toward the interior and from the central cells outward are transmitted with equal facility, that the rate of motion is much slower than that of electricity, and that only a small amount of energy is expended in the transit. Natural electric currents pass over the fiber, but no chemical or physical changes in the fibers resulting from the passage from impulses have been detected. Waste of tissue and weariness accompany the expenditure of energy, but the exact volume of waste cannot be determined.

Reformation (*rĕf-ōr-mā'shūn*), a term generally characterizing the movement started by Martin Luther (*q.v.*) and marking the establishment of Protestant churches in contrast to the Roman Catholic Church. Actually, however, it means the sequence of reformatory movements which reappear throughout the whole history of the Catholic Church, of which Luther's was certainly not the first. Even as early as the Middle Ages, individuals and especially certain monastic orders had asked for reforms of the Church "in head and members." This opposition was brought about by certain political abuses within the hierarchy of the Church which had become too obvious, or when the privileges of the clergy seemed no longer bearable to the common people, or when certain Popes or cardinals fought for policies which were seemingly to the disadvantage of specific nations.

The reason that Luther's Reformation became world-wide lies less in specific theological axioms which were represented in his teaching than in the fact that he lived at the time when Europe had expanded through geographical discoveries and colonial conquests, when the printing press



CASTLE CHURCH IN WITTENBERG

The door to which Luther nailed his 95 theses is in the center

had been invented, when interest in natural science had grown immensely, and when, sociologically, the individual had acquired a greater importance than he had had during the Middle Ages. In other words, it was the time of the Renaissance, of intellectual and spiritual beginnings which far transcended the realm of art. Thus, reformatory ideas once offered by Wycliffe, Huss (*q.v.*), and many others had a much better likelihood for realization at this time.

Originally, Luther nailed his famous 95 theses to the door of the Castle Church in Wittenberg rather in opposition to the misuses of certain practices of the Church—mainly the prevailing practice of selling indulgences—than in opposition to theological ideas. Nevertheless, this very act represents actually the beginning of the Reformation. In addition, however, as professor of biblical theology at the Univ. of Wittenberg, he quite naturally desired a clarification of the teachings of the Church, which seemed to him at this time contradictory. Theologically, he laid emphasis on faith in salvation by grace and on justification by faith. These principles of the New Testament seemed to him not sufficiently emphasized in the teachings of the Church. Since he was greatly influenced by St. Augustine, William of Ockham, Bernard Clairvaux, and other theologians, he originally had no intention of seceding from the Church, although he believed that the institution of the Pope was not of divine but of human origin, and that the chalice as an element of the Holy Mass was also the layman's, and that certain sacraments were partially erro-

neous, partially superfluous. Baptism, the Last Supper, and penance were the only sacraments he favored keeping. He also believed that every Christian was directly responsible to God and did not need the mediation of a priest. Thus he broke down the distinction between the religious and the secular.

All these ideas were articulated only gradually in his writings, by which he defended himself after the Papal courier had opened an ecclesiastical trial against him and had accused him of heresy because of his theses. Simultaneously, a growing nationalistic spirit among the Germans resulted in apprehension about the Church partly because it was Roman, and made Luther the leader of a movement which was as much national as religious. Finally the scholars of Humanism (*q.v.*), especially Erasmus of Rotterdam, saw in Luther the man who translated the results of their critical and historical research into practical theology. In the disputes which followed, as well as in his writings, he gradually increased in aggressiveness against the Roman Catholic Church. He was enthusiastically supported by the German people who wanted to break the power of Roman institutions, and by the nobility. The greater part of the German princes, especially, were interested in establishing the superiority of worldly political power over that of the Church.

Finally, on Dec. 10, 1520, Luther marked his definite separation from the Roman Catholic Church by burning (in Wittenberg) the Papal bull which excommunicated him. In contrast to the German princes, Charles V, the Holy Roman Emperor, fought against the Reformation, considering it but one of the many means of the German princes to break away from imperial power. In 1521, the emperor ordered Luther to appear at the Diet of Worms. It was here that Luther made his famous speech, ending with, "There I take my stand. I can do naught else. So help me, God. Amen." Since Luther would not recant, he was outlawed. He retired under the protection of his prince, the Elector of Saxony, to a castle at the Wartburg, where he began the translation of the Bible into German, which was published in 1534, and marked the actual creation of the modern German language.

Meanwhile, the Augsburg Confession (*q.v.*), the principal creed of Lutheranism, written by Melancthon (*q.v.*), had been presented to Charles V at the Diet of Augsburg in 1530. This Augsburg Confession was the basis for unending discussion among the various Protestant creeds which differed to a certain degree from the simultaneously originating concepts of the Swiss reformers and their leader, Ulrich Zwingli (*q.v.*). These ideas of the Swiss, although not included in the Augsburg Confession, shared, however, with Lutheran Protestantism the denial

of most of the doctrines of the Roman Catholic Church. From now on, religious differences caused almost continuous warfare between the various German countries, against the emperor and among themselves.

Ultimately the Reformation spread through the whole of Germany. Individual German princes, diets, and estates protested against the Pope and many Catholic institutions. The burning of dissenters now became common, not only in various parts of Germany, but also in the Baltic countries, especially Denmark, The Netherlands, and Switzerland. Many German states had officially accepted Protestantism, a development which was paralleled by the revolt of the peasants who began to fight not only against the princes of the Church but also against the worldly princes and nobles. Charles V, involved in wars and external political complications, was unable to check this development. After many controversies at various German diets, the religious Peace of Augsburg, concluded by the successor of Charles V, Ferdinand, in 1555, acknowledged Protestantism by legalizing it and giving the various states which professed it religious freedom. It was agreed, henceforth, that the religion of the ruler of a state should automatically become the religion of his subjects.

A last—but vain—attempt to reunite Catholics and Protestants was made in the so-called religious disputations at Worms in 1557.

The universalism of Western civilization was finally destroyed and the Western Christian world was no longer unified. Secular life became independent and the space for an autonomous secular civilization was created. Although the Roman Catholic Church remained the "one" Church, the various Protestant churches continued to differ nationally and in creed (*q.v.*).

Reformed Church (*rê-fôrm'd' chûrch*), the name used up to 1529 by the Reformation churches of Europe. With the controversy between Martin Luther and Ulrich Zwingli (*qq.v.*) over the Lord's Supper, which Zwingli regarded only as a commemorative observance, the term took on a precise meaning. It was applied to those churches, founded at first in the German-speaking Swiss cantons, which stood for reform of church life and thought under the leadership of Zwingli, Martin Bucer, John Calvin, Heinrich Bullinger, and Johannes Oecolampadius. The church is now worldwide, with special strength in Switzerland, Germany, the Netherlands, France, Scotland, Hungary, and Czechoslovakia. In addition to its sacramental doctrine, it is characterized by a "presbyterian" form of polity, an emphasis upon simplicity of public worship, and the supremacy of Biblical authority. Some divisions within the church over doctrinal and governmental issues have produced groups such as the

Christian Reformed Church (1822) and the Evangelical and Reformed Church (1934). In America, the first Reformed settlements were those of the Dutch in the New York area in 1624 and, somewhat later, the Germans in Pennsylvania. By 1948 the church had about 250,000 communicants in the U.S., nearly 1,800 churches, and several institutions of learning. Since 1950, a merger has been completed between the Evangelical and Reformed Church and the Congregational Christian Churches (*q.v.*).

Reform School (*rê-fôrm' skôol*), or REFORMATORY, a penal institution maintained by the state or Federal government to train first offenders who have been convicted of crime. Institutions of this kind are often termed *industrial schools*, since they teach various industries in connection with the common branches of study, and this name has been adopted at least in part because it is less objectionable to those who are reformed after systematic training. Usually these institutions are located on a large tract of land, frequently from 100 to 300 acres, and the industries include gardening, fruit growing, stock raising and general farming, while other vocations are taught as well. Those confined usually receive instruction half of the time, and the remainder of the day is devoted to work in the yards or fields. These schools generally have laundries, bakeries, and various shops, in order that all of the repairing as well as the domestic service be done by the inmates. First offenders are thus separated from older criminals, and are educated in the fundamentals as well as the domestic and industrial arts. The first institution of this kind in America was established by an act of the legislature of New York, in 1824, under the name of the New York House of Refuge on Randall's Island, N.Y. Today there are 56 reformatories, one of the best known being the Elmira Reformatory at Elmira, N.Y.

At the National Prison Congress of 1870, a new plan for reformatories was drawn up by a group of penologists, notably Z.R. Brockway. Out of this grew the law which instituted the indeterminate sentence for youthful offenders, thus making the length of stay at the reformatory depend on the offender's own progress and deportment. With a good record a boy or girl is allowed to leave on parole.

Practically every state maintains at least one reformatory; in most cases, the principles of the Elmira Reformatory are followed. To the academic and vocational training have been added psychiatric clinic work at the institutions and also follow-up measures after the offenders' release. It is now realized that the adjustment period after leaving the reformatory requires supervision and guidance by trained social and psychiatric workers.

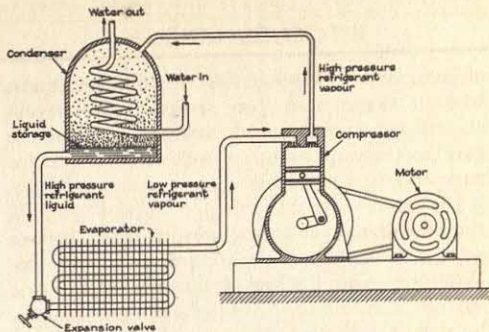
REFRACTION

The reform school described above is quite different from the state or private institutions operated by law for the custody, training, and reclamation of juvenile delinquents. Juvenile delinquents are youthful offenders who because of their age are under the law incapable of being denominated criminals as a result of acts which would constitute "criminality" when committed by older persons. See also *Juvenile Delinquency*.

Refraction (*rê-frăk'shūn*), the change in the direction of all kinds of wave motion, as in light and heat; when the waves enter obliquely a medium of a different density from that through which it previously moved. In astronomy the term is applied to the change in the direction of a ray of light resulting from its passage through the atmosphere of the earth, and, consequently, to the change in the apparent position of a heavenly body from which the light emanates. Refraction has the effect of causing the heavenly bodies to appear higher in the sky than their real position, but it is greatest at the horizon, where it is about $38'$. It decreases uniformly toward the zenith. Refraction has the effect of causing the heavenly bodies to appear to rise earlier and set later than they actually do, hence we see the sun in the morning while the entire disk is yet below the horizon. For the same reason, we see it in the evening a short time after it has passed the horizon. A familiar illustration of the refraction of light may be seen by immersing a stick partly in a glass of water, when the refraction of light will cause it to appear bent where it enters the water. It is due to refraction that the visible part of the sun during a partial eclipse appears relatively larger than the portion covered by the disk of the moon. Twilight, the gradual change from daylight to darkness, is the effect of the successive refractions of the light by the successive layers of the atmosphere.

Refrigeration (*rê-frîj-ēr-ă'shūn*), the technique of using artificial means to reduce temperature (*q.v.*). A refrigeration process may be thought of as a heat engine operating in reverse. Instead of taking heat from a high-temperature source and using it to perform work (see *Energy*)—in doing so exhausting some heat to a low-temperature reservoir (as in a heat engine)—in refrigeration, work is done in order to extract heat from a low-temperature source and exhaust it to a high-temperature reservoir. The *refrigerator* is a machine designed for this purpose.

A typical refrigerator employs the following cycle of operations. The refrigerant, often Freon (*q.v.*)—sulfur dioxide and ammonia are also common—which is initially a liquid at a high pressure and at room temperature, is permitted to pass through a valve into a low-pressure region. During this process the tem-



Courtesy American Society of Refrigerating Engineers

REFRIGERATION CYCLE

perature of the Freon drops, and some of it is vaporized. The liquid-vapor mixture now goes into an evaporation chamber, in which the rest of the liquid is vaporized. During the vaporization, heat is extracted from the contents of the refrigerator. The Freon vapor is led to a compressor, where it is compressed to a high pressure, and, during the process, has its temperature raised above room temperature. The compressed Freon is now sent through a condenser, where it is cooled to room temperature, and the heat extracted from the refrigerator is exhausted into its surroundings. Then the cycle repeats itself. In most refrigerators, the work that must be supplied in order to extract a given amount of heat is about 20 per cent of the amount of heat.

Ordinary household refrigerators consist of insulated boxes of several-cubic-foot capacity which employ the above cycle to produce low internal temperatures. *Freezers* are refrigerators operated at temperatures well below the freezing point of water; they are widely used because foods may be preserved for long periods of time at such temperatures.

The science of *cryogenics* treats of the attainment of extremely low temperatures, in the neighborhood of absolute zero (-273.16°C.), and of the properties of matter at such temperatures. Many unexpected discoveries have been made in cryogenics, for example, the fact that, at temperatures near absolute zero, metals cease resisting the flow of electric current and become *superconductors*.

See also *Air Conditioning*.

Refuse (*rêf'ūs*), a term applied to waste products. Many valuable by-products have been developed from the refuse formerly discarded by industrial concerns. Formerly gas works discarded coal-tar, which was so obnoxious to communities that the manufacturers were forced to study its disposal. To chemists must be given the credit for the present utilization of this coal-tar as one of our most useful industries, from which dyestuffs, medicines, road materials, and plastics are derived. At present intensive work is being done to

utilize paper mill wastes, such as sulfide liquor. Sewage wastes from cities are utilized for fertilizers by means of suitable treatment. The refuse from the meat-packing industry is now used for fertilizers, glue, biological products, and other substances.

Regelation (*rē-jē-lā'shūn*), the name applied to the freezing together of contiguous surfaces without the application of outward cold, as in the case of two large blocks of ice. This phenomenon is common to all substances which increase in volume upon freezing. When two pieces of ice are brought in close contact and submitted to pressure, the surfaces melt, and the two pieces are united by freezing when the pressure is relieved. Faraday discovered this phenomenon in 1850, and Lord Kelvin demonstrated that snow in the tracks of wheels is covered with a thin film of ice, owing to the fact that pressure of the vehicles causes it to melt and that it freezes as soon as the pressure is removed. According to this theory, a snowball is solidified not by compressing a given quantity of snow into a smaller body, but by small particles melting under pressure and then solidifying by regelation. The movement of glaciers is greatly modified by this phenomenon.

Regency (*rē-jēn-sy*), in art, a style which flourished in France during the early 18th century, in the time of the minority of Louis XV. Traces of the rich and pompous forms usual in the style of Louis XIV are still apparent. See also *Decoration*; *Louis Styles*.

Regeneration (*rē-jēn-ēr-ā'shūn*), the Christian doctrine of the possibility of being spiritually reborn. As sometimes hinted at in the Gospels and especially in Paul's Epistles to the Corinthians, Romans, and Ephesians, it is not strictly distinguished from the doctrine of resurrection (*q.v.*), which supposes that the faithful will rise again with Christ.

In the apocryphal Gospel of Nicodemus or Acts of Pilate of the 4th or 5th century A.D., this idea is developed in dialogue between Jesus and Nicodemus. Here, a radical and permanent change in the spiritual nature of man through faith in Christ is spoken of. Some Christian creeds hold that this new life in Christ begins by the fact of baptism, others that for each individual a new act of grace (*q.v.*) is necessary. Belief in Christ, alone, however, does not entitle the believer to regeneration; it only makes the participation in the working of the Holy Spirit or the act of Grace possible. If regeneration were automatically conferred on man by baptism (baptismal regeneration) and made each believer participate in the death and resurrection of Christ, then no new individual act of the Holy Spirit would be necessary. All Christian theological systems agree, however, that the final regeneration takes place

through an act of the Holy Spirit, greatly though they differ in their beliefs about the role of baptism in regeneration, *i.e.*, in how far it is only a preparatory condition or sufficient in itself. See also *Baptism*.

Regensburg (*rā'gēns-bōōrg*), or RATISBON, a city in Bavaria, ca. 65 m. N.E. of Munich. Located on the Danube River, it was settled before the coming of the Romans, who made it an administrative center, calling it *Castra Regina*. Later, it became the heart of early Christianity in southern Germany, and in the Middle Ages it was a center for trade with India and the Levant. A number of its buildings date back to this period, including a 13th-century Gothic cathedral and Gothic and Romanesque churches. Its old Rathaus was the meeting place of the imperial (Holy Roman Empire) diet, 1663-1806. Regensburg was besieged during the Thirty Years' War, was burned by the French in 1809, and was bombed during World War II. Population, 1957, 120,891.

Regent (*rē-jent*), the name applied to a ruler who governs a monarchy during the minority, absence or disability of the sovereign. The duties of this office usually devolve upon the nearest relative of the sovereign who is capable of undertaking them, especially in hereditary monarchies.

The term regents is applied in the State of New York to a body of commissioners in whom is vested the superintendence of public instruction, and in many states to the supervising officers of a state university (corresponding to trustees). The term is used similarly in various countries in Europe, particularly to designate certain members of the English and Scottish universities.

Reger (*rē-gēr*), MAX, pianist and composer, born at Brand, Bavaria, Mar. 19, 1873; died in Leipzig, May 11, 1916. He was taught by his father and later by Hugo Riemann, music scholar and theorist. Reger was organist of Weiden Cathedral Church (1886-89). In 1901 he settled in Munich where he became known as a composer of organ music. He taught at the Royal Acad. of Music in Munich (1905-06) and at the Leipzig Conservatory (1907-16). In addition, he made concert tours in Germany, Austria, and Switzerland and conducted the Meiningen Court Orchestra (1911-14). He was inspired by the music of the 18th-century composers, especially Bach, Hiller, and Mozart, but to their influences he added a definitely individual style. Among his compositions are: "Introduction, Passacaglia and Fugue," for two pianos, "Romantic Suite," for orchestra, and the choral works "Requiem" and "*Gesang der Verklärten*." Reger's contemporaries contrasted him to Richard Strauss and the French Impressionists as the redeemer of absolute music.

Reggio di Calabria (*rād'jō dē kā-lā-brē-ā*), a seaport city in Italy, capital of a province



Courtesy Foto-Enit-Roma

REGGIO DI CALABRIA, ITALY

The Church of St. Francis

of the same name (area, 1,233 sq. m.; pop., ca. 600,000). The city is situated on the Strait of Messina, opposite Sicily and almost at the southernmost point of the Italian peninsula. There is some manufacturing, primarily of olive and other oils. It has a cathedral, which was completely reconstructed after the devastating earthquake of Dec. 28, 1908. It is an ancient city, founded by Greek colonists late in the 8th century B.C. and named Rhegion. There are few remains of its past but the ruins of a Greek temple and a Roman bath; and two 15th-century towers are still standing. Its history includes many invasions in pre-Christian and later times; in World War II the British seized it in September 1943. Population, ca. 150,000.

Regicide (*rĕj'i-sid*), a term meaning one who kills a king, used particularly in reference to the judges who condemned to death Charles I (*q.v.*) of England. By the time the regicides came to trial, in October 1660, many of them were dead and others had fled the country. The court of 34 commissioners condemned 29 to death, but only ten were executed; the remainder were imprisoned for life. The bodies of three who were dead at the time of trial were exhumed and hanged. Three who had escaped were arrested and executed abroad.

Regillus (*rĕ-jŭl'lŭs*), in Roman history, a lake in Latium, situated southeast of Rome in the crater of the extinct volcano Cornufelle. It was the site of a battle in 496 B.C. which established Roman power over Latium, a story which is told in "Lays of Ancient Rome" by Thomas B. Macaulay (*q.v.*). The lake was drained in the 17th century.

REGIOMONTANUS

Regiment (*rĕj'i-mĕnt*), the second-largest permanent association of troops in the Army of the U.S. It is the third subdivision of an army, three regiments with supporting arms and services normally comprising a division; two or more divisions with supporting troops forming a corps; with an army being made up of a variable number of corps and divisions. The normal structure of a regiment includes a colonel in command; a lieutenant colonel as regimental executive and in command of battalions; majors for important staff positions in regimental and battalion headquarters, and two or three battalions composed of three or four companies commanded by a captain who has several lieutenants as assistants. The strength of a regiment ranges from 1,241 in an engineers' general service regiment to 3,774 in an infantry regiment. The regiment originated in France about 1560 and is now a subdivision of the troops in all armies of the world.

Regina (*rĕ-jŭ-nŭ*), a city in Canada, capital and largest city of the Province of Saskatchewan, on Wascana Creek, ca. 350 m. w. of Winnipeg. It is served by the Canadian Pacific and Canadian National railways. Situated in an extensive agricultural area, it is a shipping center for livestock and an important grain and farm-produce market. Its industries include flour milling, meat packing, automobile assembly, oil refining, printing, and the operation of machine shops. Regina Coll. and Campion Coll. are located here. Regina's public buildings include the provincial legislative building. The city was founded in 1882 and became capital of the Northwest Territories the following year. It was incorporated as a city in 1903 and became the capital of Saskatchewan when the province was created in 1905. In 1883 Regina became headquarters for the Northwest Mounted Police (reorganized in 1920 as the Royal Canadian Mounted Police); the city is now its western headquarters. Population, 1951, 71,319.

Regiomontanus (*rĕ-jŭ-ŏ-mŏn-tŭ'nŭs*), Latin name of JOHANN MÜLLER, astronomer, born in Königsberg, Franconia, June 6, 1436; died in Rome, Italy, July 6, 1476. He was educated at Leipzig and Vienna; in the latter city he studied with George Purbach (1423-61), called Purbachius, with whom he worked for many years. Together they revised Ptolemy's "*Almagest*," correcting errors in the previous translation, in preparation for which Regiomontanus traveled to Italy to learn Greek and study the original. In 1471, with a pupil and patron, Bernhard Walther, he built an observatory at Nuremberg and in the following year made important observations of the comet later known as Halley's comet (see *Comet*). His "*Ephemerides ab Anno 1475-1506*," an astronomical projection for determining positions at sea, is said to have been

used by Christopher Columbus in his voyages. In 1472 Regiomontanus was called to Rome by Pope Sixtus IV to assist in calendar reform. In the following year he was made bishop of Ratisbon. Among his other contributions to science were extensive studies in algebra and trigonometry.

Registration (*rěj-i-strá'shūn*). See *Election*.

Regnault (*rě-nyō*'), ALEXANDRE GEORGES HENRI, painter, born in Paris, Oct. 30, 1843; killed in the Franco-Prussian War, Jan. 19, 1871. He was a son of Henri Victor Regnault (1810-78), a French chemist and physicist. Regnault studied in Paris and Rome and traveled in Spain, Italy, and Africa. He won the Prix de Rome (1866) with "Thetis Giving Achilles the Arms Forged by Vulcan." His other works include "Salome" and "Lady in Red."

Régnier (*rā-nyā'*), HENRI FRANÇOIS JOSEPH DE, poet, novelist, and critic, born in Honfleur, France, Dec. 28, 1864; died in Paris, May 23, 1936. At first an adherent of the Parnassians, a school of French writers who opposed the vogue of romanticism and sought to achieve "Olympian calm" of style, he became a disciple of Stéphane Mallarmé (*q.v.*) and a leader of the symbolists (see *Symbolism*). Among his poetical works are "Poèmes anciens et romanesques" (1890), "Les Médailles d'argiles" (1900), and "La Sandale ailée" (1906). He also wrote novels and an essay on Mallarmé.

Regulators (*rěj'ū-lā-tērz*), an organization of settlers in interior North Carolina (active 1768-71) who protested against alleged oppressive measures of local government, in particular the enactment of confiscatory taxes and the extortion practiced by individual officials. They achieved some measure of success in ousting local officials and won control of the provincial assembly in 1769, but Gov. William Tryon dissolved the body. The movement spread, however, until in 1771 Tryon led a military force against a group of Regulators at Alamance Creek, near Hillsboro, completely routing them (May 16). Several leaders were hanged, and the movement collapsed.

Regulus (*rěj'ū-lūs*), a first-magnitude star in the zodiacal constellation of the Lion, frequently used in navigation. Its distance is 80 light-years.

Regulus, MARCUS ATILIUS, Roman consul and general. He was consul in 267 B.C. and again in 256. In the latter year he defeated the Carthaginians in a naval battle of the first Punic War and invaded Africa with continued success. In the following year the tide of war changed, however, and Regulus was defeated and taken prisoner by the Spartan general Xanthippus. After five years in captivity, Regulus was sent to Rome as a peace emissary for the Carthaginians, who had by then suffered serious de-

feats. According to legend, Regulus instead urged the Roman senate to reject the peace proposal and, refusing to remain in safety, returned to certain death at the hands of the Carthaginians. Regulus' name became synonymous with honor and bravery.

Rehabilitation (*rě-hā-bīl-i-tā'shūn*), the "restoration of the handicapped to the fullest physical, mental, social, vocational, and economic usefulness of which they are capable," as defined by the National Council on Rehabilitation.

Undoubtedly, much of the current growth of interest in extending rehabilitation opportunities and services to the handicapped has resulted both directly and indirectly from World War II. Recent advances, however, are not entirely due to the impetus of the war, as the growth of rehabilitation opportunities and services to the handicapped is a part of a total pattern of an expanding national and community consciousness of social welfare which is reflected in similar advances in all education, health, and social services.

Immediately following World War I there was a developing interest in increasing rehabilitation opportunities for the disabled. This interest, however, diminished somewhat in the years between the wars. From it, nevertheless, did come some pioneer institutions and some needed legislation such as the Federal-state vocational rehabilitation programs.

Rehabilitation has been termed the third phase of medicine, following preventive medicine and curative medicine and surgery. In contrast to convalescence, in which the patient is left alone to let nature and time take their course, rehabilitation is a dynamic concept in which the skills of the rehabilitation team, consisting of the physicians, physical therapists, occupational therapists, nurses, social workers, counselors, and other trained personnel, are integrated as a single force to help the patient reach the maximum of his physical, emotional, social, and vocational potentials.

The first objective of rehabilitation is to eliminate the physical disability, if possible; the second, to reduce or alleviate the disability to the greatest extent possible; and the third, to retrain the person with a residual physical disability to live and to work within the limits of his disability but to the hilt of his capabilities.

In the past, the medical attitude toward the chronically disabled has often been one of hopelessness and passive acceptance. Hemiplegic patients (persons who have suffered strokes), for example, have been considered chronically disabled. Studies have shown, however, that 90 per cent of all hemiplegic patients can be taught ambulation, self-care, and urinary and fecal continence, and 50 per cent can be taught to do



BUILDING A NEW LIFE

An auto accident victim, paralyzed from the chest down for life, begins his training at Woodrow Wilson Rehabilitation Center, Fishersville, Va. A doctor explains the injury and advises on types of work possible (*top left*). A physical therapist helps the patient develop strength to walk (*top center*). Aptitude tests help determine interests and abilities as part of vocational diagnosis (*top right*). His choice made, the patient begins studying electrical repair work (*bottom left*). His skills developed, the rehabilitated patient is visited on his new job by a counselor, who talks also with the employer to make sure that both are satisfied (*bottom right*).



gainful work suited to their reduced ability.

A more enlightened view of physical fitness in terms of ability to perform a specific task is also being developed. Physical criteria for ability to work were drawn up in the early 20th century under the then prevailing "anatomical concept" of medicine. Competency and physical ability were measured in terms of anatomical perfection; a man was either fit or unfit depending upon whether or not he was anatomically whole.

It is now known physiologically that a man can live with one-half of a lung, one-third of a kidney, one-sixty-fourth of a liver, one-half the normal volume of blood, and without a stomach. Although far from whole anatomically, he can function effectively. Thus, under the current functional concept of medicine, the individual may be physically disabled but he is not vocationally handicapped if placed in the right job. Few persons use more than one-quarter of their physical capacities in daily living. The greatest single asset in vocational success of the disabled person is the patient himself and his tremendous

powers of recuperation and compensation. The blind man, for example, compensates for the loss of sight by overdeveloping his senses of touch and hearing.

Concurrent with the growing recognition of the medical aspects of rehabilitation, there has been a significant expansion of vocational rehabilitation services in the U.S.

Under the Federal-state vocational rehabilitation program, the Federal responsibilities are discharged by the Office of Vocational Rehabilitation in the Dept. of Health, Education, and Welfare. These responsibilities include the administration of Federal matching grants to the state to provide services and research and training programs.

The actual services to disabled persons are provided by public agencies in all of the states and the Commonwealth of Puerto Rico. Each agency operates its own program in accordance with a state plan developed in cooperation with the Office of Vocational Rehabilitation.

Disabled persons are referred to state rehabili-

tation agencies from many sources—private practitioners, hospitals, health departments, public assistance agencies, crippled children's divisions, and voluntary agencies. Two recent amendments to the Social Security Act have become important as sources of referral: (1) the so-called "disability freeze," which preserves the insurance rights of eligible individuals who become totally disabled while covered by the Old-Age and Survivors Insurance; and (2) the authorization for cash payments to the totally and permanently disabled at age 50. In most states, the vocational rehabilitation agency has the responsibility for determining disability under these laws.

Generally, the criteria for eligibility are as follows: an individual must have a physical or mental disability which is a substantial handicap to employment; he must be of, or near, working age; and there must be a reasonable expectation that the services will render him fit to engage in remunerative employment. The actual determination of eligibility in each case, however, is a responsibility of the state agency. Services available under this program include medical diagnostic services, individual counsel and guidance, physical restoration, training for a job, transportation, maintenance, occupational tools, initial stocks of goods for small business enterprises, job placement, and followup.

Included in the term physical restoration are such services as medical, surgical, and psychiatric treatment, dentistry, nursing, hospitalization and clinic services, convalescent or nursing-home care, drugs, prosthetic devices, physical therapy, occupational therapy, and medically directed speech or hearing therapy. These services are available only in instances where (1) the clinical status of the individual's condition is stable or slowly progressive (*i.e.*, not acute or transitory); (2) a favorable outcome may be expected within a reasonable period of time; and (3) the individual's financial need has been demonstrated.

In recent years, there has been a growing recognition in the U.S. that while the investment in rehabilitation services is costly at first, it is an investment which pays social, economic, and personal dividends. The public program of vocational rehabilitation has doubled and new programs for the training of personnel and for research have been started. There has been a vast increase in the programs of voluntary agencies concerned with rehabilitation and in the number of community rehabilitation centers and services. Rehabilitation services have been introduced into general hospitals, nursing homes, and institutions for the aged. See also *Artificial Limbs*; *Public Health Service*; *Social Security*; *Veterans Administration*.

Rehan (*re'qan*), ADA, stage name of ADA CREHAN, actress, born in Limerick, Ireland, April 22,

1860; died in New York City, Jan. 8, 1916. She was brought to the U.S. at the age of five and at 14 made her stage debut in "Across the Continent," in Newark, N.J. After several seasons with stock companies, among them that of Mrs. John Drew in Philadelphia, she joined the company of Augustin Daly in 1879 and for 20 years thereafter starred in more than 200 plays, often as the leading lady of John Drew (*q.v.*). Her most popular roles were Shakespearean, including *Katharine* in "The Taming of the Shrew," *Viola* in "Twelfth Night," and *Rosalind* in "As You Like It." She was also a talented comedienne in roles such as *Lady Teazle* in Sheridan's "The School for Scandal."

Rehoboam (*re-(h)ô-bô'am*), a king of Judah (*ca.* 933 B.C.-*ca.* 914 B.C.), son and successor of Solomon (I Kings 11:43-12:24; 14:21-31; II Chronicles 9:31-12:16). At his succession, the ten northern tribes, under the leadership of Jeroboam I (*q.v.*), pleaded with Rehoboam to lighten the burden put upon them by his father. Rehoboam's answer, "... my father also chastised you with whips, but I will chastise you with scorpions" (I Kings 12:14), drove the ten tribes to break away from Jerusalem and establish the separate kingdom of Israel. During the reign of Rehoboam, the pharaoh Shishak I of Egypt invaded Judah and destroyed the temple of Jerusalem (see also *Shishak*). Rehoboam reigned for 17 years and was succeeded by his son Abijah.

Reichenbach (*ri'ken-bâk*), a river in the canton of Bern, Switzerland, long famous for five magnificent cascades, one with a drop of more than 200 ft. The falls now have been destroyed for a hydroelectric project. The river rises in Great Scheidegg and flows northeast into the Aare River, 16 m. E. of Interlaken. Sir Arthur Conan Doyle used the scene of Reichenbach Falls in his *Sherlock Holmes* story, "The Final Case."

Reichskanzler (*riks'kants-lër*), the title of a German public official, meaning "chancellor of the realm." In the Holy Roman Empire, and until 1806, the position was held by the archbishop of Mainz, who was entitled (after 1257) to participate in the election of the German kings. In the second German empire (1871-1918) the Reichskanzler was appointed by the kaiser. Next to the kaiser he ranked as the most powerful state official and head of the entire German and Prussian administration. In the Weimar Republic (1919-33), the Reichskanzler was appointed by the president. Under Adolf Hitler (*q.v.*), the office was merged with the presidential office upon the death of Pres. von Hindenburg in 1934, but it was revived in West Germany after World War II, when Konrad Adenauer (*q.v.*) was elected Bundeskanzler of

THE REICHSTAG FIRE

A dramatic moment (*right*) in the trial of Marinus van der Lubbe, one of five Communists accused of setting fire to the Reichstag building, shown here (*below*) still smoldering. Van der Lubbe was executed, but a seven-nation commission of inquiry cleared him and blamed the Nazis themselves (*United Press photos*)



the Federal Republic of Germany in 1949.

Reichstadt (*rik'shtät*), NAPOLEON FRANÇOIS CHARLES JOSEPH BONAPARTE. See *Napoleon II*.

Reichstag (*rik'stāk*), the traditional legislative body of the German people, which was first established as the legislative assembly of the Holy Roman Empire in the 14th century. It was composed of three groups: the electors (the princes who were privileged to elect the king), other princes, and representatives of the imperial cities. After the Thirty Years' War, as national organization became strengthened, the Reichstag evolved into a conference of ambassadors, at Regensburg, which was abolished in 1803. In the 19th century, it became the lower chamber of the parliament of the North German Confederation, and its existence continued relatively unchanged under the Weimar Republic, except that proportional representation was introduced into electoral methods. When Adolf Hitler (*q.v.*) became chancellor of Germany (1933), he sought an absolute majority in the Reichstag in elections set for March 5. At the height of the bitter campaign, on the night of Feb. 27, fire broke out in the Reichstag building, destroying much of it. Hitler's National Socialist party accused the Communists of having set the fire and obtained from Pres. von Hindenburg

emergency powers under which they outlawed the Communist party and expelled its deputies in the Reichstag; the National Socialists went on to easy victory in the election. Five Communists were tried for setting the fire, and one, Marinus van der Lubbe, a Dutch citizen, was executed, but most authorities have agreed that the National Socialists were themselves responsible. In West Germany, after World War II, the Reichstag was replaced (under the constitution of 1949) by the Bundestag, or federal diet. See also *Germany*.

Reichstein (*rik'shtin*), TADEUS, organic chemist, born in Wloclawek, Poland, July 20, 1897. He was educated in Switzerland, served (1922-37) as research assistant and professor of chemistry at the Univ. of Zurich, and after 1938 taught at the Univ. of Basel. With Philip S. Hench and Edward C. Kendall, Reichstein shared the 1950 Nobel Prize in medicine for

TADEUS REICHSTEIN

Wide World Photo



their discovery of and research on cortisone (q.v.).

Reid (rĭd), (THOMAS) MAYNE, author, born in Ballyronney, Ireland, April 4, 1818; died in London, England, Oct. 22, 1883. The son of a minister, he also was educated for the church but at the age of 20 sought a life of adventure instead. He came to America ca. 1838 and served as a captain in the U.S. Army in the Mexican War, distinguishing himself at the storming of Chapultepec. In 1849 he organized a band of volunteers to aid the Hungarian revolutionists, but the party was not in time to see any action. He then went to England and began writing novels of adventure, including "The Rifle Rangers" (1850) and "The Scalp Hunters" (1851). His novel "The Quadroon" (1856) was the basis for "The Octoroon," one of the best-known plays of Dion Boucicault (q.v.).

Reid, ROBERT, painter, born in Stockbridge, Mass., July 29, 1862; died in Clifton Springs, N.Y., Dec. 2, 1939. He studied in Boston and later in Paris, France. He is best known for his murals and his stained-glass designs. His work is represented in the Library of Congress, the stanchion in Boston, Mass., and the appellate courthouse in New York City. Reid also designed the stained-glass windows for the Rogers Memorial Church, Fairhaven, Mass. He became a member of the National Acad. of Design in 1906.

Reid, DR. ROBERT COLLESPER, railroad contractor, born in Coupar Angus, Scotland, ca. 1842; died in Montreal, Canada, June 3, 1908. After a period as a gold miner in Australia, he came to America in 1871, where he became a contractor. He had charge of construction of the international bridges across the Niagara River and the Rio Grande. In 1893 he built a railway across Newfoundland at the rate of \$15,600 per mile. Subsequently, he contracted with the government to operate the Newfoundland railways for 50 years, at the end of which time he was to own the railways as well as 4,500,000 acres of land and the telegraph lines. Public protest against this contract resulted in an agreement by which Reid's interests were transferred to the Reid-Newfoundland Co. Reid was knighted in 1907.

Reid, ARTHUR CHASTEL, naval officer, born in Norwich, Conn., Aug. 25, 1783; died in New York City, Jan. 28, 1861. He went to sea at the age of 11 and remained in the Navy for the rest of his life. During the War of 1812, he commanded the *General Armstrong*, a privateer, in which he successfully engaged three British vessels in the Azores in 1812. Since the ships he damaged had been on route to join other British vessels in an attack on New Orleans, and their delay in turn delayed the whole force, Reid is credited with playing—unwittingly—an important part in Andrew Jackson's successful defense

of the city. After the war, Reid served for some years as harbor master at New York. In 1818 he proposed the arrangement of stars and stripes



SAMUEL C. REID

Courtesy Culver Service

that became the permanent design of the U.S. flag, suggesting that the 13 stripes remain but that a star be added for each new state.

Reid, THOMAS, philosopher and author, born in Strachan, Scotland, April 26, 1710; died in Glasgow, Oct. 7, 1796. He was graduated from Marischal Coll., Aberdeen, in 1726 and remained as university librarian for ten years. During this period, he developed an absorbing interest in metaphysics and devoted many years to intensive study. He served as pastor of the parish church of Newmachar (1737-52), until he was appointed professor of moral philosophy at King's Coll., Aberdeen. In 1764 he was appointed to succeed Adam Smith (q.v.) as professor of moral philosophy at the Univ. of Glasgow. Retiring in 1781, he devoted himself to study and writing.

Reid was the chief founder of the Scottish, or common-sense, school of philosophy, which holds that the existence of things must be accepted by instinct rather than by conscious effort of mind, since such existence is impossible of proof by any known system of philosophy. Among his works are "Enquiry into the Human Mind on the Principles of Common Sense" (1764), a reply to the skepticism of David Hume (q.v.); "Essays on the Intellectual Powers of Man" (1785), a collection of his academic lectures; and "Essays on the Active Powers of the Human Mind" (1788).

Reid, WHITELAW, journalist and diplomat, born in Xenia, Ohio, Oct. 27, 1837; died in London, England, Dec. 15, 1912. He graduated from Miami Univ. in 1856 and became editor of the *Xenia News*. At the beginning of the Civil War, he became the Washington correspondent of the *Cincinnati Gazette*, in which his articles appeared under the name of *Agate* and attracted general attention. Later he proceeded south with the army to describe various engagements. In 1868 he joined the staff of the *New York Tribune* and was managing editor (1869) and editor (1870-1905) as well as principal proprietor of the newspaper after the death of Horace Greeley

REIGATE

(*q.v.*) in 1872. Reid not only maintained the high standard of the paper, but he made it a political and financial success as well, playing a prominent part in molding public opinion. President Harrison appointed him minister to France in 1889, and in 1892 he became the candidate for Vice President as running mate of Benjamin Harrison on the unsuccessful Republican ticket. He was a member of the American commission to negotiate peace with Spain in 1898. He represented the U.S. at the coronation of Edward VII in 1902, and three years later President Theodore Roosevelt made him ambassador to England, in which capacity he served until his death. He wrote a number of books relating to the Civil War and to political subjects.

Whitelaw Reid's son, OGDEN MILLA REID, was born in New York City, May 16, 1883; died there, Jan. 3, 1947. He was educated at the Univ. of Bonn, Germany, and at Yale Univ., where he received his B.A. in 1904. He was admitted to the New York bar and in 1908 became a reporter on the *Tribune*, now the *Herald Tribune*. He became editor of the paper in 1913.



United Press Photo

WHITELAW REID

Reigate (*ri'gāt*), a municipal borough in Surrey, England, *ca.* 18 m. s. of London. Principally a residential suburb, it also produces leather and glass products. Among historic landmarks are the ruins of a Norman castle; a church dating back to the 13th century, in which is buried the 2nd baron Howard, first commander famous for his defeat of the Spanish Armada (*q.v.*); and a grammar school founded in 1675. Population, 1951, 42,734.



Courtesy The Bettmann Archive, N.Y.

EXECUTION OF ROBESPIERRE

A revolutionary leader in the Reign of Terror

Reign of Terror (*rân, sir'iv*), a period of the French Revolution (*q.v.*), dating roughly from early 1793, when Louis XVI was executed and the Revolutionary Tribunal was established, to July 1794, when Maximilien Robespierre (*q.v.*) and other revolutionary leaders were put to death. It was a time of hysteria when friend accused friend, and executions after mock trials were a daily occurrence. Beginning with the nobility, the terror moved into the ranks of the lower classes, until toward the end even the revolutionists accused and executed one another.

Reims (*ri'mz*). See *Reims*.

Reinach (*re-nâsh'*), MAXIMILIAN, archaeologist, born in St. Germain-en-Laye, France, Aug. 29, 1858; died in Boulogne, Nov. 4, 1932. Beginning in 1880, he led archaeological expeditions which uncovered important finds. From 1890 to 1892 he taught at the École du Louvre. Associated with the National Museum at St. Germain from 1886, he was appointed director of the national museum in 1901. He was the author of many works on archaeology. His brother, JOSEPH REINACH (1856-1911), was a journalist and active defender of Alfred Dreyfus (*q.v.*); he also opposed creeping defection during World War I by a strong journalistic campaign.

Reincarnation (*si'ân-khî-nâ'shân*), in philosophy and certain religions of antiquity, as well as in Hinduism and Buddhism, the doctrine that the human soul transmigrates after death into another human or animal body. Modern theosophy also holds this doctrine. See also *Buddhism*.

Reindeer (*ri'ê'dêr*), an Old World member of the deer family included in the genus

REINDEER LAKE

Rangifer, native to the northern regions of Europe and Asia. It was formerly found as far south as France and Germany but in modern times is restricted to the northern parts of the Scandinavian peninsula, Finland, and the northern parts of the Soviet Union. It has long been domesticated, especially by the Laplanders of northern Scandinavia and Finland and by the natives of northern Asia, although the reindeer also occurs in the wild state in Spitsbergen and other sections of the far north. Introduced to North America between 1892 and 1902, reindeer are now found in Alaska and northwestern Canada. The reindeer and its closely related North American form, the caribou, differ from most other members of the deer family in that both sexes have antlers, those of the females being less well developed than those of the males. These antlers are shed annually by both sexes. Reindeer vary in size from a minimum weight of around 150 lb. to occasional animals in excess of 400 lb. The average height at the shoulder is from 3 to 3½ ft. Their color varies from a uniform dark brown in summer to a tawny gray in winter, although white and spotted animals of brown and white are common. Reindeer are valued principally for their meat and hides, although their milk is an item in the economy of the local owners in Lapland. Their hides are used in making fur clothing and the leather is exceptionally fine for gloves. Occasional animals are trained for draft purposes. The domesticated reindeer is managed in herds which are grazed on the range throughout the year. The herders lead a nomadic existence as the deer herds must be continuously moved to keep them on fresh pastures. They forage on such tundra vegetation as grasses, sedges, and low-growing browse plants during the summer. Lichens, commonly called reindeer moss, are an essential part of their winter diet. See also *Lichen*.

Reindeer Lake, a lake in Canada, 2,436 sq. m. in area, on the border between the provinces of Saskatchewan and Manitoba. It is drained by the Reindeer River, which flows south to the Churchill River.

Reiner (rī'nēr), FRITZ, orchestra conductor, born in Budapest, Hungary, Dec. 19, 1888. Although Reiner took a law degree at the Univ. of Budapest, he also took a music degree from the Royal Acad. of Music there, and music remained his profession. After scoring successes as a conductor in Budapest and Dresden (1914-22), he came to the U.S. to direct the Cincinnati Symphony Orchestra (1922-31). In subsequent years, he appeared as conductor of the Philadelphia Grand Opera and of the Barcelona, Berlin, Buenos Aires, Chicago, Covent Garden (London), Milan, Rome, San Francisco, Vienna, and other opera companies and orchestras. He



Courtesy Ford Motor Co.

FRITZ REINER

The conductor confers, during rehearsal, with the singer Helen Traubel. The photo was made from the position of a second-row violinist

was orchestra conductor and opera director of the Curtis Inst. of Music in Philadelphia (1934-41), and conductor of the Pittsburgh Symphony Orchestra (1938-48). From 1949 to 1953 he was one of the principal conductors of the Metropolitan Opera, and in 1953 he became conductor of the Chicago Symphony Orchestra.

Reinhardt (rīn'härt), MAX, theatrical director and stage manager, born near Vienna, Austria, Sept. 9, 1873; died in New York City, Oct. 31, 1943. Reinhardt achieved his greatest successes in his production for the Deutsches Theater in Berlin, of which he was director for many years (1905-20, 1924-32), but he was also acclaimed in other European cities, including London, where he produced "The Miracle" in 1911; Salzburg, where his directing of the Festspiele became world-famous; and Vienna. In 1923 he toured the U.S. with "The Miracle." He

MAX REINHARDT

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was noted for the powerful imaginative scope of his staging and directing of pageants, spectacles, and the plays of Shakespeare, Gorky, Shaw, Strindberg, Molière, Wedekind, and other dramatists. He initiated and supervised several notable theater enterprises in Berlin and other European capitals and was a guest producer in New York City in the season of 1927-28. In 1932 he abandoned his various theatrical projects in Berlin and a year later resigned his directorate of the Deutsches Theater. Settling in the U.S. in the late 1930's, he directed the operetta "Rosalinda" in New York (1942) and established a school of acting in Hollywood.

Réjane (*rê-zhân'*), GABRIELLE, stage name of GABRIELLE CHARLOTTE RÉJU, actress, born in Paris, France, June 6, 1856; died there, June 4, 1920. She made her debut in 1875 and in 1883 won fame for her performance in Henri Meilhac's "Ma camarade." In 1893 she created the role of Catherine in Victorien Sardou's "Madame Sans-Gêne," in which she later appeared in England and the U.S. In 1905 she founded the Théâtre Réjane in Paris.

Rejuvenation (*rê-jû-vên-â-shûn*), in medicine, a popular expression for the stimulation of certain glands in order to rejuvenate the human body. The secretions of certain glands are generally injected to obtain this end. The therapy has not yet been scientifically proved or approved; among its pioneers have been Eugen Steinach and Serge Voronoff.

Relationship (*rê-lâ'shûn-shîp*), the relation that exists between two persons on account of marriage or ancestry. The relationship between husband and wife, as well as that of others through marriage is known as *affinity*, while that due to the descent from the same ancestors is called *consanguinity*. The latter may be either lineal or collateral. By *lineal consanguinity* is meant the direct descent from one to another, as from father to son or grandson, while *collateral consanguinity* refers to those who descended from common ancestors, as the children of two brothers, who are *cousins* in relation to each other. In law, the kindred of the wife by blood are related to the husband by affinity, her brothers and sisters being respectively the *brothers-in-law* and the *sisters-in-law* of the husband. The relationship of children of cousins, popularly called *second cousins*, is not recognized in the law of most countries. Relationship by affinity and consanguinity bars service as judges or jurors in the trial of causes, and in some countries the marriage of cousins is not permitted. See also *Kin*; *Kin*, *Next of*.

Relativity (*rêl-â-tîv'î-tî*), THEORY OF. See *Einstein Theory*.

Relay (*rê'lâ*), in general, a new or fresh group of men or animals to replace or relieve an ex-

hausted set. Working in relays or shifts permits operations to continue while workers replaced by others rest. In a *relay race*, a track sport, teams are made up of runners stationed at various intervals along the course; each runner covers his specified portion of the course and is replaced by another at the exchange point, thus enabling the team to cover a long course. The famous pony express (*q.v.*) consisted of relays of both men and horses.

In electricity, a relay is a form of electrically operated switch. It consists of an electromagnet (see *Coil*) and a movable armature or plunger moved by the magnet. Current flowing through the magnet moves the armature and so closes the circuit; when the current in the magnetic circuit is cut off, the armature, by gravity or by a spring, is drawn away from the contact points and so reopens the circuit. Relays are very common in telegraph and telephone systems and control circuits. Every individual number on a dial telephone, for example, operates a separate relay at the exchange until the desired circuit is completed.

Religion (*rê-lîj'ûn*), a term indicating the relationship of man toward one or more superior divine beings. Some linguists connect the word with *relegere*, "to gather together"; others connect it with *religare*, "to bind back," or "to fasten." The first Church doctors mention often that they do not find a correct word for the relationship of man and God.

The mere problem of definition, that is, of what religion actually means, has produced a large series of more or less scholarly works, since religion, as such, is one of the most important factors in the history of mankind and in the life of each individual. Independent of the literal meaning of the word, however, the essence of religion can be understood only by following up the history of the various religions of mankind and by comparing them, in order to find out the common denominator of all of them.

Religion by no means characterizes only the belief in one God, but includes all possible contents of human creeds. Innumerable and transitory forms of religion appear in the history of human civilization. It is an open question whether fetishism, totemism and ancestor worship (*qq.v.*) can already be considered as religion. One psychological fact about men is certain: that there is a general human need for the recognition of the existence of a supreme being, regardless of its form and powers, regardless of whether the individual believes that he owes obedience to it or of whether he is dependent on it. It is also obvious that even the most perfect collection of ethical prescriptions and commandments in itself does not yet create religion, although these commandments and

ethical rules are connected with each religion. As long as these principles are not considered a duty toward God and dependent on the will of God, they represent ethics (*q.v.*), but not religion. See also *Mythology*.

According to nontheological definitions, religion may be designated as a tendency of man to feel dependent on one or more superior beings, to love these beings, to submit to them, and to revere them. While this definition covers the general attitude of mankind in all forms of religion, the specific religious experience of consciously religious individuals could be called the capacity of such individuals to apprehend the infinite without the use of reason and without exercising the human intellect—sometimes even in contrast to the human intellect (*Credo quia absurdum*). The intellectual conviction that there is one God (see *Monothéisme*), or that there are many gods (see *Polythéisme*), that men have certain duties toward the supreme beings, that human morality depends on their will, is in itself not religion because it lacks metaphysical character. The complex integration of inner and external experiences, of responses, reactions, activities, makes a religious personality.

The old assumption that religion is a result of an indefinable instinct, *i.e.*, a mere reaction, is too empirical and actually does not explain anything. This definition is as erroneous as to say simply that one is religious if one merely goes to church, belongs to a certain community, or merely loves one's neighbor. Nouthisms (see *Théisme*), atheism, and agnosticism can be very religious if this definition of religion is adhered to. Modern psychology of religion has become very cautious in its definition. It actually would define a religious personality by stating that such an individual, without belonging to any formal or informal "religion," is able and inclined to recognize any form of supernatural power which cannot be approached by mere reason and upon which man is dependent in some way.

The difference between religion and theology (*q.v.*), not recognized as such during the Middle Ages when the Church ruled all the thoughts and philosophies of European man, is that religion is something subjective, encompassing the thoughts of individual man about one or many supreme beings, his feelings toward those beings and his behavior toward them and toward other men. Theology, on the other hand, represents an objective system in which the beliefs and ideas about God held by one man or by a community of men, the form of worship according to the norms of these views, etc., are defined.

The various religions, in the popular meaning of the word religion, are better defined as religious creeds (see *Creed*). They may be grouped as polytheistic, monotheistic, and monothéistic

religions, depending on whether they recognize a multitude of deities, one superior god, or one God. Deism (*q.v.*), too, is considered a religion.

To identify religion with accumulated philosophical and intellectual knowledge, even if the result of this knowledge is a metaphysical belief, is to make the same mistake as identifying a code of ethics with religion. It would be equally wrong to identify religion with the expression of mere vague emotions or continuation of emotional stages. It has to be understood as something singular, a complex integration of various human reactions and patterns of behavior, of various human capacities, capabilities, and emotions, united under one definite singular aspect.

It may be said that all forms of religion are historically connected and related to each other, and have influenced one another in various ways that can be discovered quite easily by the study of comparative history of religion. Like art, industry, science, and society in general, religion has gone through a process of development in which each stage has proceeded gradually from antecedent factors and conditions. However, it is not studied entirely from a historical standpoint, but in its unity and entirety, with a view to learning its essence and all its essential relations. In this aspect it comprehends the philosophy of religion, and in an independent form it could not have been studied appropriately until both philosophy and theology were highly developed. See also *Philosophy; World History*.

Writers have made various estimates of the number of adherents to each of the different religious creeds supported in the world, but all of them are only approximately correct. The following table is taken from figures published for 1955, which place the entire number of religious worshippers at 2,564,840,000, as follows:

Catholics, Roman	295,511,000
Catholics, Orthodox	159,155,575
Protestants	209,866,575
Jews	11,036,875
Muslims	220,606,600
Others	1,376,523,050

See also *Brahma; Buddhism; Christianity; Judaism; Mohammedanism; Zoroastrianism*.

Religion, was or, a series of independent wars between Huguenots and Roman Catholics, based on religious differences but having strong economic implications as well. Eight civil wars were fought in France from 1562 to 1598; in the latter year Henry IV (*q.v.*) renounced Catholicism, and the Edict of Nantes (*q.v.*) established religious tolerance for the Huguenots. A notable event of the period in France was the Massacre of St. Bartholomew in August and September 1572, during which up to 30,000 Huguenots were slain.

In the Netherlands, religious wars with Spain broke out in 1568 when William, Prince of Orange, led a revolt against Philip II of Spain, leading ultimately to the establishment of the United Provinces. The dispatch of the Spanish Armada (q.v.) against England was an act of retaliation for Queen Elizabeth's assistance to Maurice of Nassau, son and successor of William. Spanish power gradually declined, and in 1609 Maurice signed a treaty for a 12-year truce with Spain. See also *Bartholomew, Massacre of Saint; France; History; Huguenots; Netherlands; History*.

Religious Liberty (*ri-lî-jî-lee lib-er-tee*), the freedom of religious opinion, the equality of all churches, or the right of every individual to worship according to his own conscience. As conceived in the U.S. and the other liberal democracies, it is the purpose of civil government neither to support nor hinder any form of religion, but the government is charged with the duty of preventing excesses and encroachments upon private rights. While on the one hand, injuries are not to be inflicted on account of religious belief, on the other, no special privileges may be granted to any class of individuals or religious associations. The state is limited to the overt act, while religion takes an account of the attitude of the mind or soul.

Ancient nations had no conception of religious liberty, but instead treated as disloyal those who preferred not to worship at the altars set up by a system of state religion. Gradually the public mind became more tolerant, but reacted in the early centuries of the Christian era, when the spread of the religion of Christ was looked upon as an interference with existing governments. Emperor Constantine, after his conversion, established Christianity by law, in 313. This was the forerunner of allying religion with civil authority in many nations. Since then, the Catholic Church has often controlled civil authority or allied itself with civil powers. It was only in the late Middle Ages, when mysticism became more influential in Roman Catholicism, that the Church became more tolerant and allowed a certain amount of religious liberty within its own ranks. The mystics believed that the religious experience was so holy, secret, and individual that external laws should not interfere with it. The Humanism (q.v.) of the Renaissance also recognized freedom and the necessity for historical research on religious facts and experiences, and therefore fought for religious liberty.

Although the Reformation (q.v.) fought against religious tyranny and for religious liberty, it was itself as strongly opposed to nonconformism as was the Catholic Inquisition to heretics. However, the mere fact that after the Reformation there existed not one all-embracing Church

but many forms of organized belief made people inclined, if not practically at least theoretically, to recognize the idea of religious tolerance. Men no longer adhered consistently to the medieval conviction that only one definite religious truth existed, that it could be finally known, and that the heretic could be coerced from his beliefs. There developed at this time what is known as territorialism, the identity of a country and the religious belief of its inhabitants.

Later, a greater degree of tolerance was achieved by diminishing the number of doctrinal demands in order to make it possible for as many individuals as possible to conform. Finally, what we call religious liberty developed, where various groups believing in different truths tolerated and respected each other. This absolute liberty is now guaranteed by the law of the U.S. and other governments. See also *Concordat*.

Remarque (*re-märk*'), ERICH MARIA, author, born in Osnabrück, Germany, June 21, 1897. He is best known as the author of the realistic novel "All Quiet on the Western Front" (1929), based



United Press Photo

ERICH MARIA REMARQUE

The author (right) played the role of an anti-Nazi German professor in the 1959 film version of his novel, "A Time to Love and a Time to Die."

on his experiences in World War I. Remarque lived in Switzerland (1930-33), then moved to the U.S.; he was naturalized in 1947. Other works include "The Road Back" (1931), "Three Comrades" (1937), "Flammen" (1941), "Arch of Triumph" (1946), "Spark of Life" (1952), "A Time to Love and a Time to Die" (1954), and "The Black Obelisk" (1956), several of which were made into motion pictures.

Rembrandt Harmenisz van Rijn (*rin*'), *leint hi'-min-iz rin rin*) or 1639, Dutch artist,



Courtesy The Metropolitan Museum of Art,
Bequest of Benjamin Altman, 1913

PORTRAIT OF A YOUNG MAN
PAINTING BY REMBRANDT

born in Leyden, July 15, 1606; died in Amsterdam, Oct. 8, 1669. The son of a miller living near Leyden, he studied in the Latin school of his native city. In 1631 he settled in Amsterdam, where he had studied art a number of years before with Pieter Lastman and Van Swanenburgh. Between 1631 and 1640 he became the most fashionable portrait painter for the rich of Amsterdam and earned a large

JACOB'S DREAM
PEN AND WASH DRAWING BY REMBRANDT



REMINGTON

fortune. In 1634 he married Saskia van Uylenburgh, who was the model for many of his paintings. His greatest artistic achievements came just after her death in 1642 when, having faded from the public eye, he met financial difficulties. Despite this and other private misfortunes, he then became the Rembrandt who is so greatly appreciated today. The magic light which he always directs so as to add dramatic accents to the story depicted in a painting now became the main characteristic of his art.

Rembrandt's artistic genius and vision encompassed portraiture, landscape, and mythological and Biblical themes, as well as still life. Scenes from the Bible were his constant inspiration, especially the events which revealed great human tragedies or heroism—he depicted them in a singularly powerful and vivid manner. The many self-portraits he produced after 1628 reveal his insight best. With growing artistic maturity, he gave less and less attention to details but made his face the mirror of his soul. Similarly, his three famous group portraits—"The Anatomy Lesson" (1632); "The Night Watch" (1642), properly entitled "The Sortie of the Banning Cocq Company"; and "De Staalmeeesters," or "The Syndics of the Cloth-Guild" (1662)—disclose his developing mastery and great simplicity.

Among his many portraits, most famous are "The Mennonite Preacher Anso Consoling a Woman" (1641), "Jan Six" (1654), and "Polish Nobleman" (1637); among his religious works, "Simeon in the Temple" (1628), "Angel Leaving Tobias" (1637), "The Pilgrims at Emmaus" (1648), and "David and Saul" (1653?) are most noted.

As a draftsman and etcher, Rembrandt also takes a unique place. Whatever his medium, he was always able to convey the full scale of human moods, emotions, and passions. See also *Art*; and color plate, *Great Paintings I*, in Volume XII.

Reményi (rě'mā-nyī), EDUARD, violinist, born in Heves, Hungary, July 17, 1830; died in San Francisco, Calif., May 15, 1898. He studied at the conservatory in Vienna but took part in the Revolution of 1848 against Austria and was compelled to leave the country. He came to the U.S. in 1849 but went to Weimar, Germany, in 1853 and later settled in England, where he became violinist to Queen Victoria. The general pardon of 1860 permitted him to return to Hungary; later he traveled as a musician, in Canada, Mexico, China, and many European countries.

Remington (rēm'ing-tūn), FREDERIC, artist, born in Canton, N.Y., Oct. 4, 1861; died in Ridgefield, Conn., Dec. 26, 1909. He studied at the Yale School of Fine Arts and later lived for some time on ranches in Montana and Wyoming. There he observed Western life and gathered

many sketches of the Indians, horses, soldiers, and men of the plains. In 1884 he began to contribute to several magazines. He was also a sculptor, and his bronzes are widely known. His works include the paintings "A Dash for the Timber," and "Conjuring the Buffalo Back," and a bronze sculpture, "The Bronco Buster."

Remote Control (*rê-môl' kôn-trôl'*), a term applying to the application of electrical currents to control apparatus at considerable distance. Remote-control systems include automatic printing telegraphs, teletypes, stock tickers, railway block-signal systems, and many others. Remote control over telegraph and telephone lines has proved useful in operating unattended power stations, radio transmitters, and electrical machinery. Radio transmitters may also be used for remote control. Many airfields are equipped with a remote-control system to enable landing aircraft to switch on lights and radio beacons. Experiments have shown that it is possible to control pilotless aircraft by radio from the ground or other aircraft. Bombs, too, can be directed by remote control. See also *Military and Naval Progress; Radio*.

Remsen (*rêm'sen*), IRA, chemist, born in New York City, Feb. 10, 1846; died March 5, 1927. After completing (1865) a course of study at the Coll. of the City of New York, he attended the New York Coll. of Physicians and Surgeons at Columbia Univ. and afterward studied in Germany. In 1872 he was made professor of chemistry and physics at Williams Coll. He became the first professor of chemistry at Johns Hopkins Univ. in 1876 and succeeded Dr. Daniel Coit Gilman as its president in 1901. Besides publishing many textbooks, he made a number of original investigations in organic and inorganic chemistry. In 1879 he founded the *American Chemical Journal*, which he edited for several years.

Rémusat (*râ-mü-zâ'*), CHARLES FRANÇOIS, statesman and philosopher, born in Paris, France, March 14, 1797; died June 6, 1875. He was educated at the Lycée Napoléon and took up journalism. In 1818 he became closely connected with the party leadership of Guizot, and published a pamphlet of considerable merit on "Trial by Jury." He became a contributor to the *Globe* in 1824. In 1830 he entered the French chambers as deputy and served until 1848. His support was given to the ministry of Casimir Périer and, when the government passed to Thiers, he became minister of the interior. Louis Napoléon exiled him when he ascended the throne in 1851. While abroad Rémusat pursued literary and scientific studies, but when Thiers became president, in 1871, was called to the portfolio of foreign affairs, in which he served with distinction until 1873. His books include "Essays on Philosophy" and several books on scientific subjects.

Renaissance (*rên-g-sân's*), French for "rebirth," the specific epoch in history which follows the Middle Ages and introduces what we consider modern times. In this general sense, it may be said to be still living in the period of the Renaissance. More specifically, as a style, Renaissance means the period from ca. 1420 to ca. 1580, near which date the baroque (*q.v.*) style appears. The Renaissance began in Italy and the "rebirth" was the rediscovery of ancient Greek and Roman art and architecture, of which the remainders existed still in Italy. The movement, however, was by no means confined to art and architecture but found its expression also in contemporary philosophy and literature. In these fields, too, ancient ideas were taken up again, helped by new discoveries in the field of natural science, geography, and astronomy.

The spiritual movement is characterized by three definite trends: First, the above-mentioned interest in antiquity which, for instance, in the arts meant the rediscovery of perspective and anatomy, which the Middle Ages had neglected. Second, the new interest in nature, which expressed itself in two ways, in the endeavor to expand natural science, and in the arts, the attempt to depict men and their surroundings in a naturalistic way, in contrast to the symbolic approach of the Middle Ages. Finally, the Renaissance brought about modern individualism. In other words, it conceived of the single human being not only as a member of a specific group—*e.g.*, a guild or a parish—or as a subject of a sovereign, as in the medieval concept, but as a definite and absolute personality. In their entirety, these three new tendencies which represent the fundamentals of the Renaissance brought with them practically a diminishing of the intellectual and spiritual power of the Church. The Church, during the Middle Ages, had been the only realm of scholarly and scientific research and learning, always in connection with theological doctrines. Now, these endeavors were followed independently of the teachings of the Church. However, it is incorrect to call the Renaissance the "revival of learning," since learning itself had not ceased to flourish during the Middle Ages. The change was in the *direction* of learning.

The landmarks of the Renaissance, as to the expansion of human knowledge are, to mention only a few: the foundation of the Copernican system in astronomy, Gutenberg's (*q.v.*) invention of movable type, the discovery of America and other regions outside of Europe, and finally, even the Reformation (*q.v.*), which actually meant the application of the new trends to religious problems. As a flowering epoch of art, the early Renaissance (called also the Quattrocento)

which brought about the change, took place essentially in Florence, and such artists as Brunelleschi, Ghiberti, Masaccio, Fra Angelico, and Fra Filippo Lippi (*qq.v.*) are the main representatives of the first generation. In the period of the so-called High Renaissance, *ca.* 1500-60, the accent shifted more to Rome, where Raphael and Michelangelo (*qq.v.*) created the center of the movement. These two cities, however, were not the only ones to witness the evolution. Leonardo da Vinci, probably the most typical Renaissance man, in his all-comprising talent for science and art equally, came from Northern Italy, and the Venetian school of the 16th century was led by men like Giorgione and Titian (*qq.v.*).

Outside Italy, the Renaissance developed more slowly, since the great stimulus of ancient remains did not exist in The Netherlands, France, England, and Germany. In these countries, it was more the humanistic studies (see *Humanism*) and less the visual arts which brought about the change; the strongest factor in common with Italy was the new interest in nature which became evident in the naturalistic tendencies of painting in these countries.

Renan (*re-nān'*), JOSEPH ERNEST, historian, philologist, and essayist, born in Tréguier, France, Feb. 27, 1823; died in Paris, Oct. 2, 1892. He entered the Seminary of St. Sulpice, Paris, where he studied for holy orders in the Catholic Church, but in 1845 he abandoned his intention of becoming a priest, although he continued to pursue the study of Hebrew, German, and other languages. He was granted a prize in 1848 for a memoir on the Semitic languages. In 1849 he was sent on a literary mission to Italy, and in 1856 became a member of the Acad. of Inscriptions. His next recognition came in the form of an appointment to study Phoenician civilization by making a tour of Syria. At this time he visited various parts of the Holy Land, and in 1863 published his famous "Life of Jesus," the first volume of his five-volume "The History of the Origins of Christianity" (1863-81). In this he expressed skeptical views in relation to many accepted traditions, which caused public opinion to turn against him to such an extent that he had to abandon his professorship of Chaldee, Syriac, and Hebrew in the Coll. of France, to which he had been elected in 1862. In 1871 he was restored to that position. He became a member of the French Acad. in 1878, received the cross of the Legion of Honor in 1880, and was made grand officer in 1888. The works of Renan are numerous; his "Life of Jesus," however, is the best known. It has been translated into many languages.

Renault (*rē-nō'*), LOUIS, authority on international law, born May 21, 1843, at Autun, France; died at Barbizon, Feb. 8, 1918. He taught Roman and commercial law at Dijon,



Courtesy British Information Services, N. Y.
THE CORONATION OF THE VIRGIN
PAINTING BY GUIDO RENI

1868-73, and then went to the School of Political Sciences at Paris. He was a professor there from 1874 to 1881, when he became professor of international law at the Univ. of Paris, remaining there until his death. In 1890 he served as counselor to the ministry of foreign affairs. Renault has been called the most important figure of the French school of international law, a subject which he actually founded as a science in France. At one time he was president of the Institute of International Law and a member of the Hague Tribunal, and he was frequently called upon to serve as arbitrator in international disputes. He shared the Nobel Prize for peace in 1907 with Ernesto T. Moneta. His most important books include "Introduction to the Study of International Law" (1879) and "Compendium on Commercial Law" (1884-85), of which he was co-author.

Reni (*rā'nē*), GUIDO, painter of the Bolognese school, born near Bologna, Italy, Nov. 4, 1575; died there Aug. 18, 1642. He studied in Bologna under Lodovico Caracci (*q.v.*), whose emphasis on beauty became the most decisive factor in Reni's work even after Reni had, for a time, been under the influence of Michelangelo Caravaggio (*q.v.*) in Rome. The latter master had introduced naturalism into Italian painting, even in religious paintings (*e.g.*, he depicted a man perspiring, or dirt on the soles of a saint). Reni, who combined this trend with a close imitation of Raphael and other Renaissance masters, leaned, however, towards the latter approach; thus the influence of Caravaggio did not affect him as

strongly as the more classicistic trends of the Caracci school. Best-known among Guido Reni's works are "Aurora" (or "The Dawn"), "*Madonna del Rosario*," and "Lot and His Daughters."

Renner (*rĕn'ĕr*), KARL, president of Austria, born Dec. 14, 1870, at Dolní-Dunajovice, Moravia; died in Vienna, Austria, Dec. 31, 1950. In 1907 he became a deputy of the Social Democratic party to the national assembly in Austria. In 1918, he was named head of the first republican cabinet and shortly afterward first chancellor of the Austrian republic. He was the Austrian signatory of the peace treaty following World War I, and retained the chancellorship and the portfolio of foreign minister until 1920. He served in the national assembly from 1921-34 and was its president from 1931-33. Arrested by the National Socialistic government in 1934, he spent some months in jail, but was released in June 1935. After World War II, he headed the first postwar provisional government of the newly established Republic of Austria, and was later unanimously elected president for a six-year term. Renner wrote several books on economic and political subjects.

Rennes (*rĕn*), a city of France, formerly the capital of Brittany, at the confluence of the Ille and Vilaine Rivers, 190 m. s.w. of Paris. It is on both sides of the Vilaine River, which is crossed by a number of stone and steel bridges. Among the noteworthy buildings are a cathedral of modern Grecian design, the palace of justice, a number of fine schools, several hospitals, and a university. The manufactures include shoes, sailcloth, cotton and woolen goods, yarn, lace, paper, and earthenware. The city is surrounded by a fertile country producing wheat, rye, and fruit. It has important railroad facilities and river and canal transportation. It is well fortified and has a large arsenal. During World War II, it was occupied by U.S. forces. Population, 1946, 113,781.

Reno (*rĕ'nô*), largest city in Nevada, county seat of Washoe County, on the Truckee River, 31 m. n. of Carson City. Reno is on the Southern Pacific and Western Pacific R.R.'s. It is the seat of the Univ. of Nevada (*q.v.*), and Stead Air Force Base is located 10 m. from the city. Reno has become known as the legal center of Nevada, chiefly because of the large number of divorces granted annually under Nevada's lenient residence laws. It is also known for its tourist attractions, including entertainment and gambling. The city's industries include lumber and food processing. The surrounding country is a rich mining area and raises livestock. Reno, settled in 1859, was incorporated as a town in 1879 and as a city in 1901. Population, 1940, 21,317; in 1950, 32,497.

Renoir (*rĕ-nwâr'*), PIERRE AUGUSTE, painter



Courtesy National Gallery of Art, Wash., D. C.

MADAME SEVERINE. PAINTING BY RENOIR

and sculptor, born in Limoges, France, Feb. 25, 1841; died in Caques, Dec. 17, 1919. He worked for a time in the studio of the painter, Charles Gabriel Gleyre, where he met Sisley and Monet. Influenced also by Courbet, Delacroix, and Corot, he became one of the leaders of French impressionism. His subjects included portraits, landscapes, still life, and peasant life, but he excelled especially in painting nude figures of women. Among his works are "Rowers' Luncheon," "The Ball at Montmartre," "The Dancer," "The Terrace," "Young Girls at the Piano," "*Les Grandes Boulevards*," "Box at the Opera"; also portraits of Claude Monet, Sisley, Richard Wagner, and of "Mme. Charpentier With Her Children." See also color plate, *Great Paintings II*, in Volume XII.

Rensselaer (*rĕn'sĕ-lĕr*), a city in Rensselaer County, New York, on the New York Central and the Boston & Albany R.R.'s. It is situated on the Hudson River, opposite Albany, with which it is connected by several bridges. The surrounding country is agricultural and dairying. The city carries on considerable trade in produce and manufactures. It has extensive railroad machine shops, lumber yards, roundhouses, and freight yards. Rensselaer was settled in 1631, incorporated as the village of Greenbush in 1815, and chartered under its present name as a city in 1897. Population, 1950, 10,856.

Rent (*rĕnt*), the payment of money, services, or produce for the use of any property. This property usually includes land, or living space; it may, however, include any item of utility from a factory to an automobile or a book. The rate of such payment is based on the market value

of the products which the operation of the land, factory, or automobile may yield, and is fixed by individual bargaining. Thus soil from which a poor harvest may be expected will rent for less than a similar area of land capable of returning a crop of greater market value. Therefore, land rent is not determined by any inherent quality in the earth itself, but by its commercial potentiality. The general characteristics of rent are (1) the agreement on a certain amount; (2) regular dates appointed for such payments; (3) unless otherwise agreed, the mutual understanding that a tenant is considered to be in arrears upon failure to make payment by midnight of the contracted day, and the immediate right of the landlord to reclaim his property. Under English common law, which American juridical principles generally follow, most statutes operate in favor of the property owner. If, for example, a payment is lost in transit through the mail, the loss falls upon the tenant.

The hypothesis upon which rent values are founded is that the number of productive instruments remains fixed. Rent, like commodity prices, is bound by the laws of supply and demand. When demand for anything rentable exceeds supply, the value of rent increases; otherwise, it drops.

Renwick (rĕn'wĭk), JAMES, physicist, born in Liverpool, England, May 30, 1790; died in New York City, Jan. 12, 1863. Of Scottish parentage, he studied at Columbia Coll., New York City, and taught philosophy and chemistry there. He was one of the U.S. commissioners who explored the boundary between the U.S. and New Brunswick. For some years he was a trustee of Columbia Coll. His books include "Chemical Philosophy," "Elements of Mechanics," "Chemistry Applied to the Arts," and "First Principles of Chemistry."

Reparation (rĕp-ā-rā'shŭn), a theological term meaning the expiation for sins offered by an individual in order to gain readmission into the community of the Roman Catholic Church, after he has been excommunicated.

Reparations (rĕp-ā-rā'shŭnz), the term applied to the indemnities assessed upon the defeated Powers, particularly Germany, by the victorious Allies (q.v.) of World War I. The Treaty of Versailles (q.v.), without fixing the total indemnity, stated that "Germany accepts the responsibility of Germany and her allies for causing all the loss and damage to which the Allied and Associated Governments and their nationals have been subjected." The amount of reparations was later fixed at about \$30,000,000,000. In 1923, Germany attempted to repudiate this obligation because of alleged economic collapse. An international board of experts was convened under the chairmanship of Charles G. Dawes (q.v.)

and promulgated what came to be known as the Dawes Plan, which fixed an annual payment by Germany of about \$500,000,000, without, however, determining a total amount. Although Germany's economy flourished under the stimulus of loans provided by the Dawes Plan, by 1929 she had succeeded in convincing foreign governments that a less exacting scheme of payments was necessary. Accordingly, a committee under Owen D. Young (q.v.), unofficial representative of the U.S., worked out another system under which Germany was to make decreasing annual payments for a period of 59 years, and established the Bank for International Settlements to distribute the receipts. When the first shadows of world depression highlighted the danger of a complete collapse of the German financial structure (1931), President Hoover of the U.S. proposed an inter-governmental moratorium for one year. This period expired, however, without bringing signs of relief, and the British government convoked a conference at Lausanne, Switzerland, in the summer of 1932. The Lausanne Agreement attempted to terminate the problem by reducing the outstanding balance to slightly over \$700,000,000, payment of which was to effect final settlement, but before payments could be resumed, Adolf Hitler assumed power in Germany (January 1933), repudiating both the debts and the agreements governing their payment.

After World War II (q.v.) a conference on reparations at Paris, 1945, established the Inter-Allied Reparations Agency to handle assessments on the defeated nations.

Repplier (rĕp-plĕr'), AGNES, author, born at Philadelphia, Pa., April 1, 1858; died there Dec. 15, 1950. She studied at the Sacred Heart Convent, Torresdale, Pa., and later at the Univ. of Pennsylvania. Her essays, frequently published in such magazines as the *Atlantic Monthly*, were characterized by wit, irony, and a pleasing, polished style. Her numerous books include "Points of View," "Essays in Idleness," "Books and Men," "Points of Friction," "In Pursuit of Laughter," and "Eight Decades."

Representatives (rĕp-rĕ-zĕn'tā-tĭvz), HOUSE OF, one of the two branches of the U.S. Congress (q.v.). The number of each state's representatives is determined by apportionment,¹ and, in 1929, the number of representatives was permanently fixed at 435. The various officers of the House and their functions are as follows:

The SPEAKER is the presiding officer of the House, decides questions of order, appoints chairmen of the Committees of the Whole, signs acts, warrants, subpoenas, and orders of the House; controls the unused rooms and corridors in the House wing

¹ Apportionment is the process of allotting to each state—by a method of equal proportions—a number of representatives on the basis of the population in accordance with the most recent U.S. census.

of the Capitol; appoints conference and special committees; the official reporters of debates, the committee stenographers, the Parliamentarian, and his office force of clerks.

The MAJORITY LEADER is elected in caucus by the Majority party and has the responsibility of conducting the legislative program, appoints the legislative clerks and other assistants provided for his office, and selects the Party Whip.

The LEGISLATIVE CLERK and others perform service under the direction of the Majority Leader.

The MAJORITY WHIP acts under the direction of the Majority Leader in ascertaining sentiment on a given question and secures the attendance of members of his party for votes on important matters; keeps in touch with the legislative program and advises Members of the time when certain bills are expected to be considered.

The PARLIAMENTARIAN is appointed by the Speaker, under whose direction he indicates the reference of public bills and executive communications to committees; furnishes precedents to the Speaker and chairman of the Committee of the Whole, confers with them and with Members concerning legislative propositions with respect to their parliamentary admissibility or otherwise, and prepares the House Manual.

OFFICIAL REPORTERS OF DEBATES report stenographically all proceedings of the House of Representatives.

LEGISLATIVE COUNSEL assist House committees in drafting bills and committee reports; also assist Members when not engaged in committee work.

The HOUSE OFFICE BUILDING COMMISSION prescribes rules and regulations governing use of all rooms and space in the House Office Buildings, and directs protection, care, and occupancy thereof.

The COMMITTEE ON RULES occupies a unique position in that it is not a legislative committee; yet it exercises influence upon legislation through special rules reported by it providing for the consideration of bills on the Majority program, and prescribing the methods of their procedure. It also reports proposed changes in the Rules of the House, and brings in resolutions creating special committees for various purposes.

CHAIRMEN OF COMMITTEES preside at committee meetings and hearings, report bills to House and conduct their consideration on the floor; may delegate these functions to another member of the committee; appoint the committee complement of clerks and assistants.

CLERKS TO COMMITTEES are appointees of the chairmen, subject to committee approval, keep minutes of meetings, assist in the preparation of reports and minutes of meetings, and are admitted to House floor when committees' bills are under consideration.

OFFICIAL STENOGRAPHERS TO COMMITTEES report stenographically hearings of House committees.

The MINORITY LEADER is selected at a conference of Minority Members; usually his party's candidate for Speaker, chairman of Minority steering committee and chairman *ex officio* of Committee on Committees which selects and nominates Minority Members on House committees; is spokesman for his party and enunciates its policies. The Minority Whip functions in conjunction with him.

The LEGISLATIVE CLERK AND OTHERS perform service under the direction of the Minority Leader.

The MINORITY WHIP acts under the direction of the Minority Leader in ascertaining sentiment on a

given question and secures the attendance of Members of his party for votes on important matters; keeps in touch with the legislative program and advises Members of the time when certain bills are expected to be considered.

MINORITY CLERKS assist the Minority Leader and the Minority Whip, and represent the Minority in the arrangement of pairs.

The DOORKEEPER is charged with the enforcement of rules relating to the privileges of the House Chamber and is responsible to the House for the official conduct of his employees; must enforce rules of decorum on the floor of the House in conjunction with the Sergeant at Arms; is also charged with the operation of the Document Room and Folding Room; supervises the janitor service, cloakroom men, pages, and messengers.

The SUPERINTENDENT OF DOCUMENT ROOM receives, files, and keeps available for use of the House, all bills, resolutions, and documents ordered printed by the House, as well as all public laws and resolutions; maintains a current card index giving the daily status of each piece of legislation introduced in the House and Senate.

The SUPERINTENDENT OF FOLDING ROOM receives and holds for distribution on order all documents placed to the credit of Representatives, Delegates, Resident Commissioners, and officers of the House.

The CHIEF JANITOR has charge of the laborers and janitors appointed by the Doorkeeper.

The POSTMASTER superintends the Post Office in the Capitol and House Office Buildings for the accommodation of Representatives, Delegates, Resident Commissioners, and officers of the House, and is responsible for the prompt and safe delivery of their mail.

The duties of the CLERK OF THE HOUSE are largely executive and quasi-judicial in their nature, and he derives his authority from the rules of Parliamentary Law, Rules of Practice (which have the force of common law), express statutes, and the printed Rules of the House. He is a continuing officer whose duties do not terminate with the *sine die* adjournment of Congress, as do the duties of the Speaker, the Majority and Minority Leaders, and some other officials. In the consideration of the sources from which the Clerk derives his authority it is correct to observe that he exercises as much authority by virtue of the unwritten rules of practice as he does under the written rules of the House and express statutes. The Clerk attests bills, resolutions, and subpoenas, is the custodian of the Seal of the House, prepares the roll of Representatives-elect, and presides at the beginning of a Congress until the election of a Speaker.

The JOURNAL CLERK keeps minutes of the proceedings of the House, writes the *Daily Journal*, and prepares and indexes it for printing; endorses all official papers at Clerk's desk.

The ENROLLING CLERK engrosses all bills, resolutions, and House amendments to Senate bills passed by the House for transmittal to the Senate; drafts and engrosses all messages transmitted from the House to the Senate; enrolls for presentation to the President all House bills and resolutions which have passed both Houses.

It is the duty of the READING CLERKS to read all matter presented to the House and to call the roll. They also keep a file of all bills, reports, etc., on the various calendars of business.

The **DISBURSING CLERK** prepares the pay rolls and pays the salaries of all officers and employees of the House of Representatives, including clerks to Members; disburses all money appropriated for operating expense of the House of Representatives, including the contingent fund and certain specific appropriations; also keeps all books, accounts, etc., for auditing purposes by the Comptroller General of the U.S.

The **PROPERTY CUSTODIAN** is purchasing agent of the House; furnishes and repairs all office equipment and keeps property records; superintends furniture repair shop.

The **TALLY CLERK** prepares and indexes the daily calendars of business of the House; records all votes by the yeas and nays and roll calls for quorum and prepares the voting records of Members.

The **STATIONERY CLERK** has charge of the Stationery Room of the House; makes purchases, and keeps the accounts of the Representatives as well as of the officers and committees of the House.

The **FILE CLERK** receives and files all papers from committees of the House, as required by the rule, and is custodian of the archives of the House.

The **BILL CLERK** has charge of numbering and printing bills and transcribing, for the *Congressional Record*, bills, resolutions, Executive documents, and reports of committees; keeps a complete record of the reference of and action on bills, resolutions, Executive documents, and reports of committees, and of their status.

The **CLERK'S DOCUMENT ROOM** receives all special orders for binding documents for Members of the House, distributes House and Senate journals, U.S. Statutes at Large, and bi-monthly index to the *Congressional Record*; receives and files all House and Senate documents.

The **TELEPHONE EXCHANGER** furnishes telephone service to all Members of the House and Senate.

The **LIBRARIAN** has supervision of the House Library and the Hall Library on the floor of the House.

The **CHAPELAIN** opens the daily sessions of the House with prayer and officiates at memorial exercises.

The **SEGREGARY AT ARMS** is the disbursing officer of Members' salaries and mileage; is charged with keeping order on the floor of the House; serves summonses to witnesses to appear before committees of the House; conducts obsequies of deceased Members.

CAPITOL POLICE are appointed by the Sergeant at Arms of the Senate and House of Representatives and are under the direction of the Capitol Police Board. It is their duty to police the Capitol Building and Grounds.

The **CAMERAMAN** keeps records of and handles all money in the Sergeant at Arms' office, assisted by tellers and bookkeepers.

HOUSE OFFICE BUILDING POLICE are appointed by the Sergeant at Arms to police the House Office Buildings.

GUARDS are appointed by the Sergeant at Arms of the Senate and House of Representatives and are subject to the rules and regulations promulgated by the Capitol Police Board.

Reprieve (*rĕ-prĭv*'), the postponement of the execution of a sentence imposed by a court of record. A suspension of this kind may be granted by the executive of a state or nation, or by the judge of such a court. However, in some

instances the right to grant a reprieve or a pardon is vested in the board of pardons, subject to the approval of the chief executive. Reprieves are granted for various reasons, including a request to investigate the legality of the conviction, the sudden insanity of the prisoner, and favorable indications in the prisoner that may appear to justify a postponement of the execution or the commutation of the sentence.

Reproduction (*rĕ-prŏ-dŭk'thŭn*). See *Birth*.
Reptiles (*rĕp'tĭl*'), a class of "cold-blooded" animals occupying an intermediate position among the vertebrates, above the fish and amphibians but below the birds and mammals. They are the most highly developed vertebrates that lack mechanisms for internal heat regulation. Reptiles, in contrast to mammals, birds, and amphibians, have an outer covering that consists of horny plates or scales. Unlike fish and amphibians, they breathe by means of lungs throughout life; gills are completely lacking. The biggest advance over the fish and amphibians is in method of reproduction. Reptiles are the first vertebrates to attain direct development free of an aquatic stage. This is due largely to the presence in the reptile egg of the amnion, the allantois, and a porous protective shell. Fertilization is always internal; however, the egg may be deposited outside the mother for the completion of development (oviparous) or may be retained within her body until the embryo is fully formed (ovoviviparous).

Living reptiles occur on all the continents of the world, with the exception of Antarctica. The maximum number of species is found in the tropics and there is a progressive decrease in number toward the poles. In the Old World two species, a lizard and a snake, live within the lower limits of the Arctic Circle. During the cold periods reptiles hibernate in situations protected from freezing. In the tropics during periods of drought reptiles enter a period of inactivity termed aestivation. Contrary to popular opinion, reptiles are not the heat-loving animals they are often thought to be and quickly succumb to high temperatures resulting from prolonged exposure to the sun.

As a group separable from the ancestral amphibians, the reptiles appeared more than 300,000,000 years ago in the carboniferous period. They flourished throughout the Mesozoic Era as the dominant vertebrates. This era, lasting more than 100,000,000 years, has been appropriately called "The Age of Reptiles." In that age lived the renowned dinosaurs, the flying pterosaurs or pterodactyls, the fishlike ichthyosaurs, the bizarre plesiosaurs, and others, including the ancestors of the birds and mammals. They varied from the size of a modern lizard up to that of the giant *Brachiosaurus* with an

estimated weight of 50 tons and *Diplodocus* with a length of 87½ ft.

Today the living reptiles are greatly overshadowed by their descendants the birds and mammals. Four main groups or orders have living representatives, whereas 10 or 12 orders are known only from the fossil records. The orders with living representatives are: the *Chelonia* (testudinata), or turtles, with an estimated 250 living species; the *Rhynchocephalia*, with one living species, the Tuatara (*Sphenodon*) of New Zealand; the *Squamata*, including the lizards, with an estimated 2,500 living species, and also the snakes, with an estimated 2,500 species living at present; and the *Crocodylia* (Loricata) or crocodilians, with 25 living species.

Turtles are chiefly aquatic or semiaquatic, although a few species are strictly terrestrial; the body is round or oval and contained within a hard or leathery shell; the tail is relatively short; limbs are always present; teeth are always lacking; and all are oviparous. Two families are adapted to life in the seas and come on land only to deposit the eggs. Maximum length of living species is approximately 8 ft., with a weight of 1,500 lbs.

The Tuatara is a very primitive reptile that superficially looks like a lizard, but differs markedly in its anatomical characteristics. This last remnant of a once widespread group is now found only on a few small islands of New Zealand. It attains a length of 2½ ft.

The lizards and snakes comprise the largest and most widespread group of living reptiles. They occur in a greater variety of habitats and over a greater area of the world than any other order. One family of snakes is adapted to life in the seas. These small snakes are not to be confused with and have no connection with the mythical sea-serpents. In the *Squamata* the body and tail are elongated and covered with scales, limbs may be present or absent, and the reproduction is either oviparous or ovoviviparous. No one single external character can be used to separate all lizards from all snakes. Snakes lack movable eyelids, external ear openings, and functional limbs. The majority of lizards exhibit these structures although one or more may be lacking in a few species. This order contains the only venomous reptiles, three species of lizards and about 20 per cent of the snake species. Of these numbers, only a few can be considered dangerous to man. The largest living lizard attains a length of 11 ft., while the largest snake species attain a length slightly in excess of 33 ft.

The crocodilians include the alligators, the caimans, the gharials, and the true crocodiles. All species are aquatic, limbs are always present, the tail is compressed and long, the head is

elongate with teeth set in sockets, the body is covered with tough horny plates many of which contain bony platelets, and the reproduction is oviparous. The maximum length attained by living species is about 33 ft.

Republic (*rĕ-pŭb'lik*), from the Latin *res publica*, meaning commonwealth, the form of government in which the sovereignty is vested in the people, the administration being lodged in officers who are elected by, and directly represent, the people. The government of the U.S. is democratic-republican, but it is generally known as a republic. In reality there are two distinct classes of governments in most republics, known as state and federal. Before the 13 original states ratified the Constitution, each possessed an independent national sovereignty. When it entered the Federal Union it became subject to the general Constitution, but it retained a dependent republican government. The nation is bound to preserve the right of republican government in each of the states, an obligation laid upon it by the national Constitution. Thus, each state has a constitution more or less similar to that of the other states, and is dependent upon and limited by the Constitution of the Federal government.

Republics had their origin in the opposition that prevailed against hereditary monarchies, as was the case in Greece, Rome, and most countries of North and South America. The essential features have continued to be, principally, the selection of the chief executive by elections and the making of laws by assemblies chosen by an enfranchised class. In ancient Greece the government of the small states partook of the nature of a democracy, where the whole body of citizens met to enact their laws, while the republics of Genoa, Venice, and others of medieval Italy partook of the nature of an oligarchy, since the right of suffrage was vested almost entirely in the nobles and a few privileged individuals. The representative form prevails in all modern republics. Nearly all have a written constitution. Almost all of them have universal suffrage. In many cases they choose the chief executive indirectly, some through an electoral college, as in the U.S., others through the legislature, as in France and Switzerland. The legislative authority is generally vested in an assembly, sometimes comprising two chambers or houses, and the judiciary has power to pass upon the constitutionality of the laws and executive acts.

Republican Party (*rĕ-pŭb'lik-ən pâr'tĭ*), one of the two major political parties in the U.S. after 1854, which has always depended for its main strength upon the Northeast and the West. Its positions, like those of the other great party, the Democratic party, have been modified by the character of national events, but it has generally

stood for high protective tariffs, a conservative national financial policy, extraterritorial acquisition, and a foreign policy which would, as far as possible, keep the U.S. more or less isolated from the other nations of the world, although this attitude was somewhat modified during and after World War II. Although at the outset the Republican party favored a strong central government and a loose construction of the Constitution, this attitude was completely reversed during the administration of Franklin D. Roosevelt (*q.v.*).

The name Republican was first applied to a political party in the U.S. in the late 18th and early 19th centuries, when the party formed by Jefferson (*q.v.*) in opposition to the Federalists was called Anti-Federalist or Democratic-Republican. This group assumed the name Republican as an advocate of a states'-rights democracy and strict construction of the Constitution. By 1820, however, it had split into several factions, the chief of which was led by Andrew Jackson (*q.v.*) and adopted the name Democrat. The present Republican party was not organized until 1854, when it was formed by opponents of the extension of slavery after the passage in that year of the Kansas-Nebraska Bill (*q.v.*). Know Nothings, Abolitionists, Free Soilers, Whigs (*q.q.v.*), and numerous Democrats banded together to form the new party. In 1856, the first national convention in Philadelphia nominated John C. Frémont (*q.v.*) for President, with a platform which opposed the extension of slavery to the territories and advocated Federally financed improvement of rivers and harbors and the building of a transcontinental railroad. "Free soil, free speech, free men, Frémont" became the rallying cry of the campaign, but Frémont was overwhelmingly defeated by the Democratic candidate, Buchanan. Two years later, however, the Republican party already had a plurality in the House of Representatives.

By 1860, slavery had become a burning issue, and the Republican party, champion of the restriction of slavery, won from the Democrats thousands of voters, who left their party chiefly because of two events. The first of these was the Dred Scott Decision (*q.v.*), in which the Supreme Court decided that Negroes were not citizens and that the Missouri Compromise (*q.v.*) was unconstitutional, since Congress did not have the right to decree that citizens might not take their slaves into a new territory; the second was Buchanan's recommendation that Kansas be admitted to the Union under the Lecompton Constitution (*q.v.*), a constitution drawn up for that state solely by advocates of slavery, free-state men having refused to vote at the election of delegates to the constitutional convention. With the aid of these renegade Democrats, the Republicans were

able to elect their first President, Abraham Lincoln (*q.v.*), whose platform, in addition to advocacy of the restriction of slavery, contained planks for a homestead law and a protective tariff.

Lincoln's years in office were largely devoted to prosecution of the Civil War (*q.v.*), but during his administration Congress passed and submitted to the states the 13th Amendment, abolishing slavery; passed a high-tariff bill; enacted the Homestead Act (1862), giving free land to any citizen who cared to develop it; and promulgated a national banking system (1863). In addition, construction was begun on the first railroad to the Pacific.

Lincoln's running mate in the election of 1864 was a Democrat, Andrew Johnson (*q.v.*). After Lincoln's assassination in 1865, a bitter feud developed between the new President and his Republican Congress, Johnson favoring far less harsh treatment of the defeated South than the Congress. This struggle culminated in Johnson's impeachment in 1868, but he was saved by a single vote from being removed from office. During his term, the 14th and 15th Amendments, protecting the rights of Negroes and guaranteeing them the vote, were submitted to the states.

In 1868, the Civil War hero, Gen. Ulysses S. Grant (*q.v.*), restored the Presidency to the Republicans. During his two terms in office, Southern reconstruction was still the nation's primary problem. Grant, wholly untrained by his experience for the office, was accused, justly or unjustly, of abusing the civil service, but he was popular with the voters and had no difficulty in winning a second term. During his first term, laws were passed to enforce the rights guaranteed to Negroes in the 14th and 15th Amendments and the first civil service law was enacted in 1871. His second term included the Panic of 1873 and was notable for the Resumption Act of 1875, providing for the resumption of specie payments (*q.v.*).

Another Republican, Rutherford B. Hayes (*q.v.*), succeeded Grant in 1876. One of his first acts was to withdraw Federal troops from the reconstructed Southern states, thus virtually giving the Democrats the opportunity to disfranchise the newly enfranchised Negroes. Hayes was succeeded in 1880 by the Republican, James A. Garfield (*q.v.*), who was assassinated shortly after his inauguration and succeeded in turn by his Vice President, Chester A. Arthur (*q.v.*). Arthur's administration was responsible for the Pendleton Civil Service Act (1883), which introduced the policy of competitive examinations for civil servants, and for the Chinese Exclusion Act (1882), which denied Chinese nationals admission to the U.S.

In 1884, the Republican candidate, James G. Blaine, lost the state of New York and the Presidential election probably because voters took of-

fense when the Democratic party was called the party of "rum, Romanism, and rebellion" by a Republican, although Blaine himself was not the author of the slogan. The Democratic candidate, Grover Cleveland (*q.v.*), served a term as President, but the Republicans returned to power in 1888 under the leadership of Benjamin Harrison (*q.v.*), who ran on a platform which endorsed the protective tariff and anti-monopoly legislation. During his term, Congress passed (1890) the Sherman Anti-Trust Act (see also *Trusts*), which had the purpose of protecting trade and commerce against unlawful restraint and illegal monopolies, and the McKinley Tariff Act (1890), which raised the tariff and inaugurated the principle of reciprocal tariffs.

Cleveland was re-elected in 1892 and during his second term in office lowered the tariff. This was alleged to be one of the main causes of the depression which occurred during his administration, and the tariff thus became the chief issue of the campaign of 1896, although the issue of the gold standard *vs.* the free and unlimited coinage of silver was scarcely subordinate by election day (see also *Bimetallism*). The Republican candidate, William McKinley (*q.v.*), won over the Democrat, William Jennings Bryan (*q.v.*). One of McKinley's first acts was to sponsor passage of a new protective tariff, and a gold-standard (*q.v.*) law was passed in 1900. The most important event of his first term, however, was the Spanish-American War (*q.v.*), as a result of which the U.S. acquired Puerto Rico, Guam, and the Philippine Islands. Hawaii was annexed in 1898 and Samoa in 1899. In the latter year, the U.S. established the "open door" policy (*q.v.*) in China. The skillful diplomacy and far-sightedness of McKinley's Secretary of State, John Hay (*q.v.*), who also served under McKinley's successor, Theodore Roosevelt (*q.v.*), was responsible in large measure for the increasing prestige and importance of the U.S. in world affairs during this period.

McKinley was re-elected in 1900, but was assassinated in 1901 and succeeded by his Vice President, Theodore Roosevelt, who was one of the most colorful and forceful of U.S. Presidents. At home, he took important and far-reaching steps to curb the power of big business; abroad, he did much to strengthen the position of the U.S. as a world power. Among the outstanding accomplishments of his two terms in office were the beginning of construction of the Panama Canal; the prosecution of monopoly and regulation of trusts (*q.v.*); more adequate regulation and inspection of the production of foods and drugs; curbing of the railroads' practice of levying discriminatory rates by strengthening the powers of the Interstate Commerce Commission (*q.v.*); and the first determined effort to conserve

and reclaim natural resources (see also *Conservation*). In foreign affairs his avowed policy was to "speak softly and carry a big stick." He was instrumental in bringing about a settlement of the Russo-Japanese War in 1905.

Roosevelt was easily elected in 1904, but he declined to run for a third term in 1908. William Howard Taft (*q.v.*), whom Roosevelt had chosen as his successor, was elected. During his term, the 16th Amendment, authorizing a Federal income tax, and the 17th, providing for direct election of U.S. Senators, were both submitted to the states.

In 1912, the Republican party split into two groups, one supporting Taft and the other, the Progressive wing, which called itself the Bull Moose party, supporting Theodore Roosevelt. This split probably won the election for the Democratic candidate, Woodrow Wilson (*q.v.*), whose popular vote was considerably less than that of the two Republicans combined. Wilson was re-elected in 1916. By 1919, however, there were more Republicans than Democrats in both houses of Congress, and it was against this opposition that Wilson began his fight for Senate ratification of the Versailles Treaty (*q.v.*) and the Covenant of the League of Nations (*q.v.*). Henry Cabot Lodge (*q.v.*), Republican chairman of the Senate Foreign Relations Committee, is the man upon whom chief responsibility must fall for the fact that the Senate refused to ratify the treaty and to accept the League Covenant. He opposed Wilson wholeheartedly, singlemindedly, and successfully.

In the campaign of 1920, the issue was whether the U.S. should or should not become a member of the League. The Republicans opposed joining and their candidate, Warren G. Harding (*q.v.*), was an easy victor. During his administration, separate treaties were signed with Germany and Austria and war debt agreements were made with other nations. Harding was also responsible for calling the Washington Naval Conference of 1922 (see also *Naval Disarmament*). His administration is perhaps best known, however, for the Teapot Dome Scandal (*q.v.*).

Harding died in 1923. His Vice President, Calvin Coolidge (*q.v.*), served out the unexpired year of the term and was himself elected in 1924. During his rather uneventful session in office, the country enjoyed unusual business prosperity, but the crash came early in the term of his successor, Herbert Hoover (*q.v.*), who was elected to office in 1928. Hoover's chief attempts to check the effects of the depression included establishment of the Federal Farm Board for agricultural relief; a moratorium on World War I debts among the nations of the world; and creation of the Reconstruction Finance Corporation (*q.v.*) to protect savings and credit, with later authority

to make loans to the states for relief. It is possible that Hoover underestimated the seriousness of the economic situation in the country. In any case, it had improved little by 1932 and Hoover was overwhelmingly defeated by the Democratic nominee, Franklin D. Roosevelt. One important issue of the campaign was that of prohibition (*q.v.*), since it had by that time become obvious that the 18th Amendment, passed in 1919, had failed in its purpose. The Republicans supported a return to local option in the 1932 campaign; the Democrats advocated complete repeal of the Amendment, which was repealed in 1933.

After Roosevelt's death early in his fourth term in 1945, the Republicans won control of both the Senate and the House of Representatives in 1946, but in 1948 Harry S. Truman was returned to office and the Democrats regained control of Congress. In 1952 and 1956 the Republicans won with Dwight D. Eisenhower and gained a slight majority in Congress, losing control of Congress again in 1954 and later elections. In 1960 Vice President Richard M. Nixon was nominated for President and Henry Cabot Lodge for Vice President against the Democratic candidates, John F. Kennedy and Lyndon B. Johnson. The Democrats won and retained control of Congress.

Repudiation (*rê-pû-di-ã'shûn*), the rejection of the whole or part of a contract, debt, or obligation. The several states are limited by the Constitution in that they may not pass laws to impair the obligations of contracts, but the 11th Amendment provides that the Federal Supreme Court has no jurisdiction in suits brought against a state by a citizen of another state. Hence, states have been free either to repudiate or to acknowledge debts, but most acts of repudiation have occurred only on grounds of unlawful or fraudulent transfer coupled with failure of consideration.

Resaca de la Palma (*râ-sâ'kâ dâ lâ pâ'lâ'mâ*), BATTLE OF, an engagement of the Mexican War, fought on the plains at Resaca de la Palma, in Cameron County, Texas, on May 9, 1846. The Americans under Gen. Zachary Taylor had an army of 2,300 men, while the Mexicans under Gen. Mariano Arista numbered about 5,000. The center of the battle was in a heavily timbered ravine. Although both sides lost heavily, the day was won for the Americans by a charge of dragoons.

Reservation (*rêz-êr-vâ'shûn*), a tract of land set apart by the government for public uses or for special purposes. A large number of reservations have been made in different parts of the country for divers purposes, such as providing sites for forts and government buildings, preserving forests, and retaining sections of country for the special use of the Indians. The most extensive reservations in the U.S. are the Yellowstone National Park (*q.v.*) and the tracts set

apart for occupation by the Indians. See also *Indians*; *Monuments*; *Parks*.

Reserve Officers' Training Corps (ROTC) (*rê-sêrv' ôf'is-êrz trăn'ing kôr*), the principal source of officers for Officers' Reserve Corps (*q.v.*). Organized under the National Defense Act of 1916 into Senior Division units at selected colleges and universities and Junior Division units at military and other schools, it provides specialized military training, leading to commission in the Officers' Reserve Corps. Instructors and equipment are furnished by the government.

Reservoir (*rêz'êr-vwôr*), the term applied to any receptacle for storing up a fluid, but employed most extensively in describing an artificial basin to retain water until it can be used in economic and industrial enterprises. Reservoirs are divided into several classes, of which the more important are for storage, impounding, settling, and distributing purposes. In many cases great engineering skill is required to plan the constructions of basins of this kind, since the pressure is an item to be considered, as well as freezing, flooding, and influences exercised by overflows.

Storage reservoirs are frequently formed by constructing a dam across some stream, but in many instances they are made either in part or wholly by excavations and embankments. To this class belong the great reservoirs connected with the Croton dam, which supplies part of New York City's water. It has a capacity of about 35,500,000,000 gallons. The Wachusett dam of Boston retains about 63,000,000,000 gallons; the Periyar dam of India, 100,000,000,000 gallons; and the Assuan dam of the Nile, about 280,000,000,000 gallons. The greatest reservoir in the U.S. is Lake Mead, formed by Boulder (Hoover) Dam, holding 10,544,302,000,000 gallons of water, covering an area of 162,700 acres with a length of 120 m. *Impounding reservoirs* are constructed by building a dam across some stream, the purpose being to flood the country above. *Settling reservoirs* are maintained to purify the water by aerating and permitting the mud to settle. *Distributing reservoirs* are comparatively small and serve to retain a supply of water in different parts of the city. Formerly the construction was largely of stone, but cement and concrete are now the principal materials used in building reservoirs.

Resins (*rêz'inz*), any of a variety of solid organic substances. They are usually soluble in organic solvents, insoluble in water, and are non-conductors of electric current. They have no definite melting point; some soften over a wide temperature range and others do not soften but char and eventually burn. Resins are classified broadly into the groups *synthetic* and *natural*.

Synthetic resins are largely intermediates in the plastic industry, and exist as molding powders, cast resins, adhesives, and laminating resins. They

vary in appearance from sticky, tacky films to dry, crystal-appearing powders. Resins are produced on a very large scale (hundreds of millions of pounds annually), being derived extensively from coal tar as well as from cellulose and other sources. Examples are phenol-formaldehyde resins, polyvinyl acetate resins, polyvinyl chloride, glyptal resins, and many others. See *Plastics* and *Synthetics*.

Natural resins are derived chiefly from plants and are produced by oxidation of volatile oils found in the latter. They may be colored (sometimes brown or reddish yellow), but are generally transparent or translucent. They may be obtained from fossils, extraction from plants with alcohol, or from direct exudations of plants. Examples are amber, asphalt, and lignite from fossils; benzoin, turpentine, myrrh, copal, storax, and various other natural exudations. Many of the natural gums and resins are used in pharmaceutical preparations and in medicine.

Respighi (rēs-pē'gē), OTTORINO, conductor, composer, born at Bologna, Italy, July 9, 1879; died in Rome, April 18, 1936. After study at Bologna, St. Petersburg, and Berlin, in 1913 he became a professor of composition in Rome, when later (1923-25) he was also director of the Royal Conservatory of St. Cecilia. He was well known throughout Europe and America as a conductor and pianist, frequently interpreting his own compositions. He composed several operas, including "*Re Enzo*" (1905), "*La Campana sommersa*" (1927), "*La Fiamma*" (1934), and the operatorio, "*Maria Egiziaca*" (1932). Of his many symphonic poems, the best known are "*The Fountains of Rome*" and "*The Pines of Rome*." He transcribed Bach, old lute compositions, and edited Monteverdi's "*Orfeo*."

Respiration (rēs-pī-rā'shūn), the gas exchange which constantly takes place between a living organism and its environment. In the case of animals, this gaseous exchange is primarily a taking in of oxygen (*q.v.*) from the air and a giving off of carbon dioxide (*q.v.*) to the air. The exchange of gases takes place by means of various kinds of structures in different kinds of animals. No special structures are required in the single-cell animals; oxygen passes in and carbon dioxide out through the cell membrane by a process known as diffusion. In higher animal forms, various specialized structures, such as tiny spiracles opening into tubes in the bodies of insects, the gills in mollusks and fish, and the lungs of mammals are used to bring oxygen into the body and remove carbon dioxide from the body. Oxygen is essential for the metabolism of all living cells in animals, and a constant supply must be available. Carbon dioxide is a universal waste or end product of metabolism. If the supply of oxygen were completely cut off from a man,

as it would be if he breathed a gas containing no oxygen, he would be unconscious in less than 60 sec. and die in a few minutes.

In man, respiration may be divided into three phases: the movement of air into and out of the lungs, which is called *breathing* or *ventilation of the lungs*; the exchange of gases between the air of the lungs and the blood circulating in the lung capillaries, which is designated as *external respiration*; and the gaseous exchange between the blood and tissues at the tissue capillaries, known as *internal respiration*. All three of these processes, with the help of the circulating blood, serve the purpose of delivering oxygen from the air to the tissue cells and of removing carbon dioxide from the tissue cells to the outside air.

The movement of air into and out of the lungs is accomplished by the breathing muscles, which, on contracting, are capable of increasing the size of the chest or thoracic cage in which the lungs lie. When the chest is increased in size, air moves into the lungs; and when the chest is decreased in size, air is forced out of the lungs. These muscles are activated by nerves which are controlled by the respiratory center in the base of the brain. The most important stimulus to the respiratory center is the carbon dioxide of the blood. When the carbon dioxide of the blood is increased as it is in exercise the rate and depth of breathing are increased. The increased breathing then removes the excess carbon dioxide and returns the situation to normal again.

During quiet breathing, an average-sized adult man breathes at a rate of about 16 to 18 times per minute and inhales about 500 cc. (1,000 cc. is a little more than 1 qt.) of air with each breath. This volume of air, known as the tidal volume, constitutes only about one-eighth to one-tenth of the maximum volume that can be exhaled after a maximal inspiration. This latter volume is the "vital capacity." Even after a forced expiration, a volume of air called residual air, amounting to about 1,500 cc., remains in the lungs. Normal breathing, then, is a process by which a volume of outside air, rich in oxygen and containing practically no carbon dioxide, is taken into the lungs to dilute a larger volume of lung air, which contains less oxygen and more carbon dioxide; and then an equal volume of this mixture is exhaled. By this means, the concentration of oxygen in the lung air is maintained at about 15 per cent and the concentration of carbon dioxide at about 6 per cent. In the lungs, oxygen diffuses across the thin capillary membrane that separates the lung air from the blood and enters the blood. In the blood, most of the oxygen combines with the hemoglobin (*q.v.*) which is contained in the red blood cells and is carried in this form into the left side of the heart, where it is pumped out to all tissues of the body. As the blood goes

Retort (*rê-tôrt'*), a vessel used for the decomposition of compound bodies by heat, or for distillation. The retort of the chemical laboratory is of glass, platinum, porcelain, or other heat-resistant and chemical-resistant material. It consists essentially of a bulb with a long neck attached, in which the products of distillation are condensed, and from it pass into the receiver. Retorts are of various shapes, and materials differ somewhat with the uses they are to serve.

Retriever (*rê-trêv'êr*), a breed of dog which is trained to retrieve, *i.e.*, to locate and bring wounded or killed game to the hunter. See *Dog*, and color plates, *Types of Dogs I and II*, Volume IV.

Reuchlin (*roi'k'lin*), JOHANN, humanist, born in Pforzheim, Germany, Feb. 22, 1455; died in Bad Liebenzell, June 30, 1522. He studied in Freiburg, Paris, and Basel, before entering the service of Duke Eberhard of Württemberg in 1481. He later became a judge in the Swabian League (1502-13), and taught Greek and Hebrew at the Univs. of Ingolstadt and Tübingen. One of the leaders of German humanism, he championed the study of the Greek language and its contemporary pronunciation in Germany, through writing textbooks on this language, as well as editing and translating Greek authors. He advocated also the study of the Hebrew language, was the author of the first Hebrew grammar written by a Christian (1506), and translated the penitential psalms from the original Hebrew. Reuchlin's importance lies primarily in his emphasis upon the learning of languages as philosophical systems in themselves. Thus he anticipated what today would be called semantics and philosophy of meaning in contrast to the merely philological approach.

Réunion (*râ-û-nôg*), formerly BOURBON, an island in the Indian Ocean, situated *ca.* 450 m. E. of Madagascar; its area is *ca.* 970 sq. m. The island is of volcanic origin, but the craters are largely extinct, except for Piton de la Fournaise, in the east. The surface is mountainous, ranging from 2,000 ft. to *ca.* 10,065 ft., which is the height of the Piton des Neiges. The chief products are sugar, vanilla, and plants used in making perfume. The principal exports are sugar, essential perfume oils, and rum. Port-des-Galets (French, Pointe des Galets) is the chief port. A 79-m. coastal railroad connects the west with the east.

About a fifth of the population is of European origin, mostly descendants of French settlers. Portuguese navigators discovered the island in the 16th century, and it became a French possession in 1649. As an overseas department of France since 1946, it is governed by a prefect and an elected general council. It is represented in the French assembly. Saint-Denis (pop.,

45,000) is the capital. Population, 1956, 295,000.

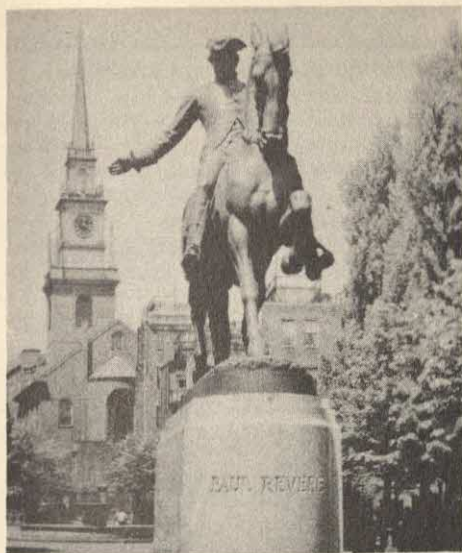
Reuter (*roi'têr*), FRITZ, novelist and poet, born in Stavenhagen, Germany, Nov. 7, 1810; died in Eisenach, June 12, 1874. He studied under private tutors until 1832, when he entered the Univ. of Jena, and in 1833 engaged in revolutionary agitation against the Prussian government, which resulted in his imprisonment. He was set free in 1840, and thereafter gave his entire attention to literature. Most of his poems and some of his novels are written in the *Platt deutsch* dialect.

Reuter, LUDWIG VON, naval officer, born in Germany in 1869; died in Berne, Switzerland, Dec. 21, 1943. In World War I, Adm. Reuter took part in the Battle of Jutland. He is now best known for having been in command of the interned German fleet at Scapa Flow (*q.v.*) which was scuttled under his orders (June 21, 1919) to prevent it from falling into Allied hands. He retired in 1920.

Reuter, PAUL JULIUS, BARON VON, born ISRAEL BEER JOSAPHAT, pioneer in news services, born in Kassel, Germany, in 1816; died in Nice, France, Feb. 25, 1899. He founded (at Aachen, 1849) a telegraphic and carrier-pigeon office for collecting and transmitting news. Filling a great need, this enterprise rapidly grew into the international Reuter's News Agency. Reuter moved the agency's headquarters to London in 1851, whence, noted for speed and accuracy, the Reuter agency dominated world newsgathering for half a century before other firms created serious competition. Reuter's news was thought so reliable that the agency enjoyed the great confidence of the British government. Reuter, a naturalized British citizen, was created a baron by the Duke of Saxe-Coburg-Gotha (1871).

Reuther (*rôo'thêr*), WALTER PHILIP, labor leader, born in Wheeling, W.Va., Sept. 1, 1907. At the age of 15, in Wheeling, he became an apprentice tool and die maker. Later, in Detroit, he completed his high school education and attended Wayne Univ. for three years while working for the Ford Motor Co. Interested in labor problems, he went, with his brother Victor, on a three-year bicycle tour of Europe and the Orient, where they observed factory and labor conditions and the labor movements in various countries.

He returned to Detroit in 1935 to organize the United Automobile Workers' West Side Local 174, of which he became president. He was elected to the executive board of the International UAW in 1936, and was active in the 1937 Detroit sit-down strikes (see *Strike*). He became director of the UAW's General Motors Dept. in 1939, and served as vice president of the International Union from 1942 to 1946, when he was elected president after leading a 118-day strike against General Motors. The strike resulted in large gains



Courtesy Boston Chamber of Commerce

PAUL REVERE

Statue by Cyrus E. Dallin (1861-1944)

for the auto workers, although Reuther was forced to back down considerably from the terms he had first demanded. Because of his hatred of Fascism and Communism, his proposal for rigid conversion of the automobile plants to war production during World War II (the "Reuther Plan") attracted national attention.

Reuther defined labor's part in an integrated society as follows: "We shall hold on to our (labor's) gains only by making progress with the community—not at the expense of the community." He has, however, been a strong critic of the Taft-Hartley Act. He was elected president of the Congress of Industrial Organizations in 1952 and a vice president of the merged A.F.L. and C.I.O. in 1955.

Reval (rēv'el). See Tallin.

Revelation (rēv-ē-lā'shūn), BOOK OF, the name of the last book of the New Testament, which is sometimes called the *Apocalypse of St. John*. It has been the subject of more or less discussion, since both the authorship and the date of its composition are uncertain. Issued at a time when religious persecutions were practiced, it was probably written in opposition to the practices of the Roman empire, but at the same time to encourage the faithful to persevere until the coming of judgment and the deliverance. In the first part are letters written to seven Christian churches in Asia Minor, which are followed by visions and prophecies relating to the fall of Jerusalem, the power of the world that opposes Christ, and the glory of the heavenly and eternal Jerusalem. See *Apocalyptic Number*.

Revere (rē-vēr'), a city in Suffolk County,

REVISIONISM

Mass., 4 m. N.E. of Boston, on the Boston & Maine R.R. A residential suburb and resort, the city is chiefly noted for its beach (4½ m. long), state-owned but controlled by a metropolitan district of 48 communities; and for its two race tracks—nearby Suffolk Downs for horse racing, and Wonderland Park, a dog track. It is also an important bulk-oil terminal. The site was settled (1626) as Rumney Marsh, became North Chelsea (1846), and was renamed Revere (1871) in honor of Paul Revere. Population, 1940, 34,405; 1950, 36,763.

Revere, PAUL, patriot, born in Boston, Mass., Jan. 1, 1735; died there, May 10, 1818. He was a goldsmith and practiced copperplate engraving. Many events of the times preceding the Revolutionary War were illustrated by him in engravings and caricatures. He was one of the prime movers of the Boston Tea Party and on April 18, 1775, he warned the citizens of Lexington and Concord of the intended expedition of the British. His dramatic nighttime ride to warn them was made the subject of Longfellow's poem "The Midnight Ride of Paul Revere." He entered the army at the beginning of the war and attained the rank of lieutenant colonel of artillery. After the war he established the Revere Copper Co., which is still doing business. It was the first company to refine and roll copper in America. He laid the cornerstone of the Massachusetts capitol (1795) and founded the Charitable Mechanical Association.

Revision (rē-vēr'zhūn). See *Atavism*.

Revisionism (rē-vīzh'ūn-iz'm), a movement founded in 1889 by the German Social Democratic writer and politician, Eduard Bernstein (1850-1932), who proposed a reinterpretation of Marxism (q.v.). The movement grew out of the increasing gulf between the practical needs of Marxism and its theoretical formulation. In 1899 Bernstein published his *Die Voraussetzungen des Sozialismus und die Aufgaben der Sozialdemokratie*, in which he criticized Marx's economic theory and the theory of violence, and refuted his overestimation of the state. Seeing no sign of the collapse of capitalism, but rather an increasing differentiation and complexity in its structure, he urged compromise with all the progressive forces of society and the use of democratic (parliamentary) rather than revolutionary methods. He criticized the materialistic conception of history, emphasizing the independence of ideological factors in history, and redefined Socialism as a movement towards a co-operative scheme of society.

In Italy, Germany, and Austria the revisionists remained a minority within the Marxist movement. In France, they became a government party for a time, when they joined the liberals in a left bloc for the defense of the republic during the

Dreyfus case. Although revisionism was crushed by the official organ of the International, in practice the Marxist parties outside of Russia tended to assume an increasingly revisionist role. See also *Marxism; Socialism*.

Revival (*rê-viv'äl*), the revitalization of forgotten spiritual ideas or movements. The best-known revival in the history of Western civilization is the Renaissance (rebirth), which actually created a new epoch of human history by reviving ideas, philosophies, concepts, and works of art of antiquity.

Revival, more specifically, means certain religious movements within Protestantism since the 18th century. There have also been Jewish revivals, and the foundation of almost every monastic order from the early Middle Ages to the time of the Jesuits meant a religious revival within the Catholic Church, as did also the Crusades. Even the Reformation proper, with the preceding movements like that of the Hussites in Bohemia, may be considered as religious revivals.

The Moravians, the Pietists (*q.q.v.*), and some other smaller Protestant sects were based on the revival of the original ideas of the Reformation. Best known, however, is the revival brought about by Charles and John Wesley and George Whitefield in England; it originated in Oxford in 1729. It was first called Evangelicalism and later took on the name of Methodism. In contrast to the teachings of the Anglican High Church, this revival emphasized the need to imitate the life of Christ. This doctrine was especially preached by William Law (1686-1761), who, however, considered himself as standing within the Anglican Church. His mystic experiences and his asceticism influenced John Wesley strongly. The example of the Moravians and of the Pietists contributed further to the spiritual development of the Wesleys. Almost simultaneously, various revivalistic movements took place in New England and other parts of North America under the leadership of Jonathan Edwards (1703-58), who was originally a Congregationalist minister. His special role was to permeate the rigid Calvinism with the warmth of personal religious experience. Among his followers in the English colonies were Joseph Belamy (1719-90), Samuel Hopkins (1721-1803), and Nathaniel Emmons (1745-1840). New England theology was essentially influenced by these men.

The so-called "Great Awakening," which stirred the souls of the New England colonists under the influence of these men and of William Tennent (1673-1745) and his son Gilbert Tennent (1703-64), must also be called a revival.

A second period of revivals, the "evangelical reawakening," began in America during the 19th century, characterized less by specific theological

ideas than by special ways of proselytism and propaganda. Although all Protestant churches participated in it, it was most conspicuous in the Methodist church. Open-air and camp meetings, fervent sermons, and a personal approach were characteristic of this form of revival. The Chau-tauqua (*q.v.*) assembly was one of the last outgrowths of this movement, although there the emphasis gradually shifted from religion to education.

Great revivals in the U.S. and England characterized the years 1859-61 and 1874-76. Even in the 20th century, the approach of the Salvation Army, as well as the methods of the Oxford Movement (*q.v.*), can still be called revivalistic.

The activating periods of revival in the 20th century, in contrast to the earlier ones, are characterized by their limitation in time. The active work does not extend over a longer period than two months. Single members and the community as a whole are approached and exhorted to prove their Christian belief and practice, and new members are recruited. This work is done either by local ministers or by certain evangelists who excel by their oratorical gifts and the warmth of their approach.

Revolution (*rêv-ô-lü'shün*), any fundamental change in government, or a revolt against an existing government and the establishment of a new one in its stead. Revolutions are mainly brought about by internal causes. However, the change must be accomplished completely to constitute a revolution, otherwise it is generally termed a *rebellion*, or an *insurrection*. Among the notable revolutions of modern times is that of England in the 17th century, which began in 1642 with a quarrel between Charles I and Parliament and ended in 1649, when the king was executed. A republic was organized with Oliver Cromwell as protector, but the monarchy was restored in 1660 with the return of Charles II. In 1688 James II was driven from the throne by a revolution. The American Revolution began in 1776, when the colonies declared their independence of Great Britain. It ended with the surrender of Cornwallis at Yorktown in 1781. The great French Revolution (*q.v.*) began at Paris in 1789 and ended with the beheading of Louis XVI on Jan. 21, 1793, although some writers place the end in 1794, when Robespierre was guillotined. Two other revolutions occurred in France. Revolutionists in 1830 deposed Charles X and placed Louis Philippe on the throne; the Revolution of 1848 established the Second Republic. Some writers regard the establishment of the Third French Republic, in 1871, as a revolution. The governments of South and Central America were practically all established by revolutions against Spain. The Republic of Brazil was established by revolution against Portugal. The

REVOLUTIONARY WAR

German Republic was set up by revolution in 1918. In 1936 Leftist control of Spain was challenged by Rightists under Gen. Francisco Franco, and in 1939, after three years of civil war, Franco finally overthrew the legal government. The most important revolution of modern times was that in Russia (q.v.) in 1917.

Revolutionary War (*rěv-ô-lū'shŭn-ăr-ŷ war*). See *United States: HISTORY*.

Revolver (*rě-vôlv'ěr*), a firearm which resembles the pistol, but differs from it in having a cylinder so arranged that the cocking of the hammer revolves it and brings the next cartridge in line for firing. Many kinds of revolvers are in use. They have from five to nine chambers in the cylinder and differ widely in size and mechanical construction. Some are cocked by means of pulling the hammer back with the thumb, while others are self-cocking; that is, they may be cocked and discharged by simply pulling the trigger. Others are made with a concealed hammer, thus guarding against the danger of being discharged by accident. Some revolvers have a safety latch to prevent them from being fired without first releasing the internal hammer by pressure. In 1818 Elisha H. Collier patented the first weapon of this kind in the U.S., and in 1835 Samuel Colt invented the famous revolver that bears his name.

Reykjavik (*ră'kyà-věk*), the capital of the Republic of Iceland, situated on the southwestern coast of the island, overlooking a large bay. The city has a considerable trade in merchandise, and due to its location in the North Atlantic was an important base for U.S. forces during World War II. Population, ca. 45,000.

Reymont (*ră'mônt*), WLADYSŁAW STANISŁAW, author, born in Kobile Wielkie, Poland, May 7, 1868; died in Warsaw, Dec. 5, 1925. During his youth, Reymont transferred from one kind of employment to another. He later wrote at least one novel about almost every field he had entered. His first book, "A Pilgrimage to the Bright Mountain," appeared in 1894. "The Promised Land" appeared in 1899. His best and most ambitious novel was "The Peasants," an epic in four volumes, "Autumn," "Winter," "Spring," and "Summer," which he wrote (1904-09) in



REYNARD THE FOX

Paris. For this realistic saga of the life of the peasants of his native land, Reymont, who has been called "the Polish Zola," won the Nobel Prize for literature in 1924.

Reynard the Fox (*rě'n'ěrd the fōks*), an epic fable of unknown origin, drawn from the folklore of various European countries. The story itself has innumerable versions, differing in details, but all following the Aesopic form in which animals speak and act as if they were human. This type of fable is usually a parable, with a hidden meaning intended to point a moral. In the fable of Reynard the satire on courts and courtiers is as sly as the fox which is its hero. The earliest versions are known to have been in Latin, but they were followed by others in French, German, and Flemish, mostly between the 10th and 14th centuries.

The story always follows the same general line, dealing with the adventures of Reynard after he has failed to join all the other animals assembled at the court of Nobel the Lion to pay homage to this king of beasts. The wily fox manages to dispose of several messengers sent by the king to summon him to court, tricking each one to his undoing by playing upon some special interest or weakness. When Reynard is caught at last and brought before the king, he wins a royal pardon by a "last-minute" speech from the gallows in which he implicates others in a plot against the king—also letting drop a subtle hint about a great "treasure" he has buried somewhere. The king sets him free, to go and find the treasure. However, he talks the king into believing a story that he must first go to Rome on a pilgrimage he has previously sworn to make—and Reynard is free. Brought before the king



REVOLVER

Courtesy Smith & Wesson, N. Y.



Courtesy Metropolitan Museum of Art, N. Y.

MASTER HARE. PAINTING BY JOSHUA REYNOLDS

once more on charges that he was up to his old tricks against other less cunning beasts, Reynard again talks Nobel into freeing him to "find the treasure." He manages to postpone a showdown on that point, in the meantime winning by trickery a duel with his special enemy, Isengrim the Wolf. By this time Reynard has gained such power with the king that he is made chancellor of the kingdom, and all the beasts have to pay him honor. Obviously, this fable was well adapted to put over a writer's ideas concerning a government he considered despotic, without danger to the author, and it became one of the most popular of all the animal fables handed down to us from the Middle Ages.

Reynaud (*râ-nô'*), PAUL, lawyer and politician, born in Barcelonnette, France, Oct. 15, 1878. His active career in French politics included cabinet posts of increasing importance: minister of finance (1930 and 1938-40), of the colonies (1931-32), of justice (1932 and 1938), premier, minister of foreign affairs, and minister of defense (all in 1940). While he was premier, France was invaded by the Germans and surrendered (June 1940). Opposing armistice proposals of his cabinet, he resigned and was subsequently interned by the pro-German government of Marshal Pétain (*q.v.*). He was charged with "war guilt" at the trials at Riom, France (1942), and eventually sent to a German prison. Liberated in May 1945, he testified against Pétain at the latter's trial in July 1945. He was elected a member of the assembly in June 1946.

Reynolds (*rên'ülz*), JOHN FULTON, soldier, born in Lancaster, Pa., Sept. 20, 1820; killed in

RHEA

battle at Gettysburg, July 1, 1863. He was graduated from West Point Military Acad. in 1841, was given a commission as first lieutenant in 1846, and served in the Mexican War. After the war he served against the Indians in Utah, and in 1859 became commandant of cadets at West Point. In 1861 he was made brigadier general of volunteers and took part in the campaigns of the Army of the Potomac. He was taken prisoner but was exchanged soon after. He became major general in 1862 and in the same year succeeded Gen. Hooker in command of the First Army Corps, but on the first day of the Battle of Gettysburg he was killed in action by a rifle ball. A number of monuments have been erected to his honor.

Reynolds, SIR JOSHUA, painter, born in Devonshire, England, July 16, 1723; died in London Feb. 23, 1792. The most famous of the great English portrait painters, Reynolds became the first president of the newly founded Royal Acad. of Painting in London (1768). His paintings are characterized not so much by original creativeness as by a subtle blending of stimulations which he had received from the classical Italian painters, from Raphael to Titian; from the former he took over the strictness of the organization of his compositions and from the latter his brilliance and blending of colors. He did not, however, neglect the Dutch and Flemish masters and tried to borrow as much as he could from Rembrandt and Frans Hals as well as from Rubens. This mixture, as well as the sentimental sweetness of his portraits, made his work appear rather artificial, although he was held in high esteem by his contemporaries. His bitterest enemy was the much greater artist, William Hogarth (*q.v.*), who then was less highly regarded. Reynolds was also interested in theory and aesthetics, and wrote the well-known "Discourses" and three essays in the *Idler* (1759-60), including the famous one, "On the Grand Style in Painting," in which he tried to establish general laws for painting. Among his most famous paintings are "Mrs. Siddons as the Tragic Muse," "Nelly O'Brien," and his portraits of Samuel Johnson, Laurence Sterne, and David Garrick.

Rezaieh (*râ-zâ-ê-yâ'*). See *Rizaiyeh*.

Rhadamanthus (*râd-â-mân'thūs*), in Greek mythology, a son of Zeus by Europa and a brother of Minos, King of Crete. At Thebes he married Alceme, the widow of Amphitryon, and subsequently he conquered and became the ruler of the Cyclades. Because of his reputation for integrity, Rhadamanthus was made a judge in the lower world, and as such was associated with Minos and Aeacus.

Rhea (*rê'ə*), one of several South American birds in the order Rheiformes; also a genus of this order. They are found in the Amazon and La Plata valleys and south to the Strait

of Magellan. The rhea is allied to the ostrich, but is distinguished from it by having no tail, three-toed feet, and a covering of feathers on the neck and head. Although the wings are unfit for flight, they are more highly developed than those of the ostrich and the emu of Australia. The body stands about 3 ft. high, and the male is somewhat larger than the female. The plumage is brownish in color. The plumes of the wings are marketed for dust brooms; they are inferior to those of the ostrich and are rarely used for ornamentation. One male is usually associated with two or more females, who build a common nest and lay from 20 to 30 eggs, which are incubated by the male. These birds feed on grass, berries, worms, and insects. In case of danger they run swiftly, using the wings as an aid to swiftness. See also *Ostrich*.

Rhea, or CYBELE, in Greek mythology, the daughter of Uranus and Gaia; that is, of Heaven and Earth, and the wife of her brother Cronus, a Titan. According to some writers Rhea was the symbol of the reproductive power of nature. Her place of worship was in Crete, on Mt. Ida, where she is said to have given birth to Zeus.

Rheden (*rē'dēn*), a residential city of The Netherlands, situated on the IJssel in the Gelderland province about 6 m. E. of Arnheim. Population, ca. 30,000.

Rheims (*rēmz*) or REIMS, a city in France, in the Marne department, on the right bank of the Vesle River, ca. 80 m. N.E. of Paris. Located in a fertile region, it is the center of the French

champagne industry and one of the important cities of France. It is noted for its textile industry and its university. Rheims was the Durocor-torum of the Roman Empire, capital of the Remi tribe. The site of the coronation (496) of Clovis I, it became the traditional place of coronation of French kings—including that of Charles VII (1429), in the presence of Joan of Arc (*q.v.*). The Cathedral of Notre Dame, one of the finest examples of Gothic architecture, was begun in 1211; it is famous for its statuary and its rose and other stained-glass windows. In World War I the church was virtually destroyed; it was restored, however, with the aid of John D. Rockefeller, and was reopened in 1938. Rheims suffered heavy damage in both World Wars. In 1945 the German unconditional surrender and the signing of the World War II (*q.v.*) armistice took place here. Population, 1954, 121,145.

Rhetoric (*rēt'ô-rĭk*), a Greek term for the art of public speaking with the purpose of persuasion. The definition and characteristics of rhetoric were frequently topics of ancient writers. Attic orators, among them the Athenian An-tiphon (480?-411 B.C.), were as famous as the Greek philosophers. The most famous document pertaining to the rhetoric of the ancients is Aristotle's treatise (*ca.* 325 B.C.), in which he tries to examine the characteristic qualities of rhetoric and to discover its relationship to logic and grammar. The scientific method of Aristotle ruled the period from Alexander the Great (356-323 B.C.) to Augustus (63 B.C.-A.D. 14); even the most famous Roman orator, Cicero (106-43 B.C.), was entirely dependent on earlier Greek orators and writers on rhetoric. One of the great Roman orators of the 1st century A.D. was Quintilian. His treatise, "*De Institutione Oratoria*," combines practical advice with philosophical considerations and includes a short critical history of Greek and Roman orators before him. Rhetoric was taught in the Roman academies as it had been taught earlier in the Greek academies.

Rhetoric continued to be one of the elements of general education, along with grammar and logic, through the Middle Ages. With the advent of the Reformation, rhetoric was revived as a field of academic study although it was no longer an element of general education. After the age of enlightenment of the 18th century, rhetoric gradually disappeared from the universities as a specialized field of study.

Rheumatic Fever (*rōo-mā'fĭk fē'vēr*), an acute and chronic systemic infection, of which the exact causative agent is unknown, although the streptococcus organism has been strongly suspected. The infection commonly involves the heart and its valves and lining, and characteristically the joints of the body, as well as vari-

RHEIMS CATHEDRAL



ously the central nervous system (brain and spinal cord), lungs, pleura (lining of chest cavity and covering of the lungs), and peritoneum (lining of the abdominal cavity and covering of the viscera). The disease is serious, as the most common cause of heart disease and permanent heart damage in children and young and middle-aged adults. Rheumatic fever is prevalent in the more heavily populated areas of the Temperate Zone, with a predilection for children of the 5- to 15-year age group, although it may first manifest itself at any age up to about 35. By far the most cases are found in people with low incomes and crowded and unsanitary living conditions, and frequently several cases occur in the same family—both in parents and children—but direct-contact transmission of the condition has not been proved. Once acquired, the infection may become chronic, with long periods of remission (relative freedom of symptoms and signs) and occasional flare-ups.

The infection varies in severity, and in cases of heart disease later diagnosed as being of rheumatic origin only about 50 to 60 per cent give a definite history of knowledge of the original acute infection which may be (1) without symptoms, (2) a prolonged unexplained mild to moderate fever with heart symptoms following, (3) disregarded simply as "growing pains," (4) manifested as chorea (see *St. Vitus' Dance*), (5) indicated by frequent unexplained nosebleeds, or (6) manifested as acute polyarthritis—migrating pain, swelling, and tenderness of the joints, especially the hands, feet, knees, and elbows.

The usual case of acute rheumatic fever has a sudden onset with fever (temperature of 101 to 104° F.), which drops slightly each morning. A sore throat may have been noted one to two weeks before, not infrequently of streptococcal origin. The fever is accompanied by drenching acid sweats, and migratory involvement of many joints. One or more joints become painful, red, hot, and swollen, and then after a few days they improve, while other joints begin to show the same process. After a few weeks (usually four to six) this condition subsides without residual joint damage. Scattered small red rounded skin nodules, myalgia (muscle pains), and subcutaneous nodules about joints and tendons may variously occur during the acute stage of the disease.

The acute phase may be followed by complete recovery, but many patients may be left with permanent heart damage which is not manifested until considerably later when signs of a heart affliction may become apparent. Frequently the acute stage recurs one or more times, usually increasing the damage to the heart. Occasionally rheumatic fever is overwhelming and death due to heart failure occurs within a short time. Treatment of the acute condition includes absolute

bed rest in quiet surroundings, keeping the joints relatively immobile, and highly nutritious diet.

After the fever has subsided, *i.e.*, the acute phase has passed, tonsilectomy (surgical excision of the tonsils) is often done because of the frequent association of rheumatic fever with tonsillitis (acute or chronic infection of the tonsils). Those victims left with permanent heart damage (rheumatic heart disease) must frequently change their occupations and ways of living to more sedentary conditions in order to avoid the danger of heart failure and early death. Research in the cause, prevention, and cure of rheumatic fever and rheumatic heart disease is one of the greatest problems of modern public health and medical science.

Rheumatism (*rōō'mā-tiz'm*), a nonspecific medical term, commonly used, especially by lay people, to refer to various aches, pains, swelling, or tenderness of muscles and joints, regardless of the cause. Muscle pains are commonly seen in acute diseases such as influenza, grippe, common cold, and acute rheumatic fever, and after over-exposure to damp and cold. Joint pains and stiffness and frequently swelling may be symptomatic of arthritis (*q.v.*) and are also characteristic of rheumatic fever (*q.v.*).

Rh Factor (*är äch fāk'tēr*), a recently discovered factor (or substance) inherent in the red blood cells of 87 per cent of the white race and 95 per cent of the colored race. The factor was so named from Rhesus monkeys in which it was first discovered. It constitutes virtually a fifth blood group in addition to the conventionally known and used blood (*q.v.*) groups I, II, III, and IV (or Types O, A, B, and AB) which must be properly matched in cases of transfusion. It has but very recently been proved that lack of consideration for and improper matching of the Rh factor has been perhaps a major factor in previously unexplained transfusion reactions when donor and recipient blood were known to be properly matched according to the conventional groupings. The Rh factor is known also to be responsible for the development of *hemolytic disease* (abnormally rapid production of and destruction of red blood cells) in newborn infants. This disease is also called *erythroblastosis fetalis* (meaning abnormally large numbers of immature and nucleated red blood cells in the circulation of the unborn or newborn infant). The very severe and fatal form of hemolytic disease is called *hydrops fetalis* because of the swollen and macerated condition of the usually deadborn infant. Briefly, the Rh factor is involved as follows in the development of hemolytic disease of infants: If the father of the child is Rh positive (*i.e.*, has the Rh factor in his blood) and the mother is Rh negative (*i.e.*, does not have the Rh factor in her blood) the child may inherit

the Rh factor and develop antigenic (capable of causing a reaction) substances which pass across the placenta (afterbirth, by which the child is attached inside the womb) into the blood of the mother and there develop antibodies (substances capable of reacting with an antigen). These antibodies may then pass back across the placenta into the blood of the fetus (*q.v.*) where they act as hemolytic agents and start a sequence of interlocking pathological changes such as severe anemia, jaundice, liver damage, blood-vessel damage, generalized swelling, etc., which if allowed to continue may result in death of the infant. Treatment consists of transfusion of the proper type blood into the infant to the extent of completely replacing its original blood. If antibodies develop in the blood of an Rh negative mother in her first pregnancy, successive pregnancies are likely to produce infants with hemolytic disease.

Rhine (*rīn*), or **RHEIN**, an important river of Europe, one of the finest streams in the world, closely associated with many historical events. It rises in Switzerland, has a general course of about 765 m. toward the north and west, and flows into the North Sea. Two streams form the Rhine in the Swiss canton of Grisons, which are known as the Upper Rhine and the Lower Rhine. A short distance below the junction it passes through Lake Constance and at the town of Basel turns toward the north and enters Germany, in which country most of the river is located. The part from the vicinity of St. Gothard's Tunnel to Basel is generally known as the Upper Rhine; the part from Basel to Cologne, as the Middle Rhine; and from Cologne to the North Sea, as the Lower Rhine. It enters Holland south of Arnhem, after turning toward the west, but soon divides into numerous branches, entering the sea by a delta.

The Rhine is an important commercial highway, being navigable a distance of nearly 600 m. It is connected by numerous canals with other river systems including those of the Danube and the Rhône. On its banks are many important cities, including Arnhem, Leyden and Utrecht, in Holland; Bonn, Coblenz, Cologne, Düsseldorf, Mainz, Mannheim, and Ludwigshafen, in Germany; Basel and Schaffhausen, in Switzerland. The principal tributaries are the Aar, Moselle, Main, and Neckar Rivers. Much of the land of the Rhine delta has been redeemed by dikes. See also *Lorelei*.

Rhine, **BATTLE OF THE**, one of the most important campaigns of World War II. The Battle of the Rhine, climaxing in the fall of Cologne (Mar. 2, 1945), the seizure of the Ludendorff Bridge at Remagen (Mar. 7), and the crossing of the Rhine by the Ninth and First U.S. Armies, respectively, marked the beginning of the disintegration of the German armies on the Western European

front. While the Remagen bridgehead was expanded by the Americans, British troops attacked the Germans in the north, the Ruhr district was threatened and finally isolated, and the Third U.S. Army broke across the Moselle on Mar. 16. With the successful conclusion of the battle, Germany suffered the loss of one of her largest industrial areas and over 200,000 prisoners, killed and wounded.

Rhine Cities (*sīt'īz*), **LEAGUE OF THE**, was founded by certain Rhenish towns about 1250 with the purpose of maintaining peace. It was dissolved about 1400.

Rhine, **CONFEDERATION OF THE**, a league of German princes, united under the protection of Napoleon I in 1806, and including all the German states except Prussia, Brunswick, Hesse, and Austria. After Napoleon's defeat at Leipzig, the confederation was dissolved in 1813.

Rhinegold (*rīn'gōld*), **THE**, or *Das Rheingold*, title of one of Richard Wagner's music dramas, the first of his great cycle, "*Der Ring des Nibelungen*." With this work, the *Festspielhaus* in Bayreuth, the Wagnerian operatic stage, was opened in 1876. The opera had its première in Munich, Germany, in 1869.

Rhineland (*rīn'land*), a region of Germany, comprising the *Länder* of North Rhine-Westphalia (area, 13,111 sq. m.; pop., 1954 est., 15,193,300) and Rhineland-Palatinate (area, 6,656 sq. m.; pop., 1954 est., 3,313,800) of the Federal Republic. Drained chiefly by the Rhine and Moselle rivers and their tributaries, the Rhineland lies partly in the North German lowlands and partly in the plateaus that rise to the mountains of the south. It is a region of great fertility and mineral wealth, the most populous and most highly industrialized area of Germany. The Ruhr (*q.v.*) district lies in the Rhineland, as do the cities of Aachen, Coblenz, Cologne, Dortmund, Duisburg-Hamborn, Düsseldorf, Essen, Krefeld, Mainz, Trier, Worms, and Wuppertal (*qq.v.*).

By the treaty of Versailles (1919), the Rhine Province of Prussia was occupied by Allied troops. The left bank of the Rhine and a strip 50 km. wide on the right bank were to be permanently demilitarized. Under Adolf Hitler's regime, German troops entered the demilitarized zone in March 1936. In World War II the province was captured by the Allies, following the battle of the Rhine (see *Rhine, Battle of the*) in 1945. In the postwar period new *Länder* were created out of the Rhine Province and territory previously belonging to Westphalia, Hesse, and Bavaria.

Rhineland (*rīn'lān-dēr*), county seat of Oneida County, Wisconsin, 102 m. n.w. of Green Bay. It is on the Wisconsin River, at the Pelican Rapids, and on the Chicago & Northwestern and other railroads. Manufactures include paper products, lumber, boats, sleds, and novelty jewelry.

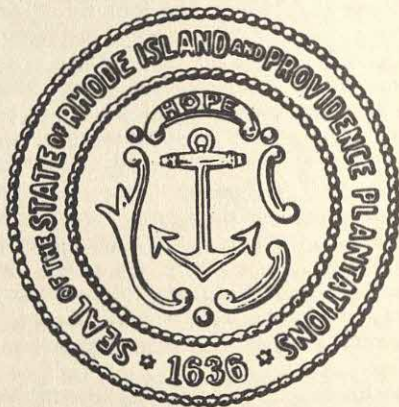
The lakes and streams in the vicinity attract many tourists. It was settled about 1882 and incorporated in 1894. Population, 1950, 8,501.

Rhinoceros (*rī-nōs'ēr-ūs*), a large massive ungulate of the order *Perrissodactyla*, or odd-toed ungulates, that lives in the broken bush country and plains of tropical Asia and Africa. It is a short-legged animal with a huge, thickset body covered with a tough—almost naked—hide. The head is large, long, and massive, with small eyes. One or two horns grow from the middle line of the muzzle. A rhinoceros horn is a dermal growth, has no bony attachment to the skull, and consists of an agglutinated mass of hair. It continues to grow throughout the life of the animal. The rhinoceros has three toes on the forefeet and three on the hind feet, encased in horny hoofs. It feeds exclusively on foliage and grasses, is most unsociable, and has very poor eyesight. Though it never looks for trouble, the rhinoceros will, without provocation, charge almost any large moving object which crosses its path. Its huge size and tough hide make it immune from attack by the large carnivores. Rhinoceroses like to wallow in mud and dust holes to rid themselves of skin parasites; they are usually accompanied by so-called tick birds which feed on these parasites.

There are five distinct races in the family *Rhinoceroidea*. The great Indian, or one-horned, rhinoceros (*Rhinoceros*) is the largest and best-known species found in Asia, frequenting the giant grass plains of northern India, Assam, and Nepal. Both sexes have the single horn, which rarely exceeds a foot in length. Large bulls stand over 5 ft. at the shoulder and weigh two tons or more. Cows of this species usually have a single calf, born 18 months after mating. The Java one-horned rhinoceros, smaller than the Indian species, is found through the Malay Peninsula and neighboring countries. The Sumatra rhinoceros is the only Asiatic species with two horns; its range originally covered much the same territory as the Java rhinoceros, but it is now quite

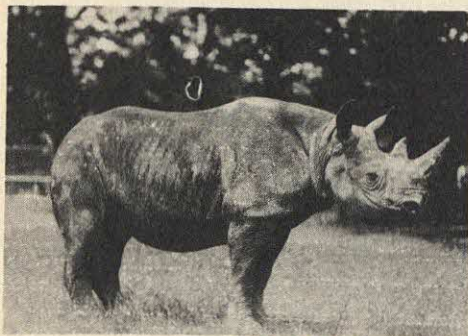
rare. The smallest living species, it stands about 4 ft. at the shoulder and weighs about one ton. The African black rhinoceros (*Diceros*) is the common species found in Africa south of the Sahara. It has two well-developed horns. A full-grown bull of this species weighs three tons. The white rhinoceros (*Ceratotherium*) is smoky gray in color and gets its name from wallowing in mud that dries white. It is the largest of the living rhinoceroses, and large bulls have a shoulder height of 6 ft. The white rhinoceros is more or less sociable and is frequently seen in groups of six or seven individuals.

Living rhinoceroses are survivors of an age when Africa and the Northern Hemisphere were populated with a large variety of primitive species. *Baluchitherium*, the largest known land mammal—a primitive rhinoceros of Asia during the Miocene era—stood 17 ft. at the shoulder and was 34 ft. long. The woolly rhinoceros, a contemporary of the mammoth whose remains have been found in Siberian ice, lived in the Arctic region of Europe and Asia.



Rhode Island (*rōd ī'lānd*), a state in the Northeastern section of the U.S., one of the 13 original states of the Union and the 13th to ratify the Federal Constitution. Although it is the smallest state, Rhode Island figures prominently in the industrial panorama of the country and is historically an important member of the New England group.

Rhode Island is bounded on the N. and E. by Massachusetts, on the S. by the Atlantic Ocean, and on the W. by Connecticut. It ranks 50th in size among the states and 36th in population, according to the 1958 estimates of civilian population (Alaska, Hawaii, and the District of Columbia included in both rankings). History has two versions of the derivation of the state's name, first applied to the island of Rhode Island (subsequently also called Aquidneck) in Narragansett Bay. According to one account, Giovanni



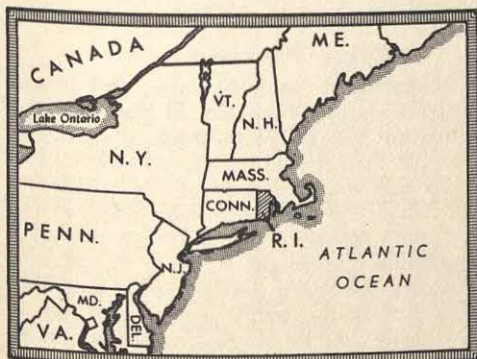
Courtesy N. Y. Zoological Society

da Verrazano, on a visit to Narragansett Bay in 1524, was struck by the resemblance between its largest island and the Greek island of Rhodes. According to the second account, the name comes from the Dutch words *Roodt Eylandt*, meaning "red island," given originally to the island because of the color of the wild roses which grew there. "Little Rhody" is the state's most popular nickname. Others include the "Land of Roger Williams," and the "Southern Gateway of New England." Rhode Islanders are sometimes called "Gunflints," after the type of gun used during the Dorr Rebellion.

Location	Between 71°08' and 71°53' W. long. and 41°18' and 42°01' N. lat.
Area	1,214 sq. m.
Land	1,058 sq. m.
Inland water	156 sq. m.
Greatest extent:	
North to south	ca. 48 m.
East to west	ca. 37 m.
Population (1950)	791,896
Capital city	Providence
Highest point	Jerimoth Hill, (812 ft.)
Lowest point	Sea level (Atlantic Ocean)
Entered the Union (13th state)	1790
Song	"Rhode Island," words and music by T. Clarke Brown
Flower	Violet (unofficial)
Bird	Rhode Island Red
Motto	"Hope"
Flag	See color plate in Vol. XI

GEOGRAPHY

Topographically, Rhode Island can be divided into three main areas: the upland, the lowland, and the island regions. The upland is in the west and comprises two-thirds of the state. Here are low round hills which reach their highest point (812 ft.) at Jerimoth Hill in the northwest. Forests and lakes mark this area. In the lowland region in the east, gently rolling hills slope down to sea level at the Atlantic Ocean. The dividing line between the upland and lowland regions snakes north-south from near Woonsocket in the northeast, down to the Great Swamp and Ninegret Pond on the southern shore.



The island region is a group of islands in the southeastern part of the state. Here lies Narragansett Bay, which extends 28 m. inland toward the north. In this pocket are the main islands of Aquidneck (Rhode Island), Conanicut, and Prudence, and the smaller islands of Dutch, Patience, Hog, Dyer, Goat, Gould, Rose, and Hope. A separate piece of mainland lies east of these islands, adjoining Massachusetts. Tiverton is its principal town. Narragansett Bay drains most of the state's principal rivers, the Providence, Seekonk, Pawtuxet, and Blackstone. Most of this southeastern area lies no higher than 200 ft. above sea level. There are virtually no mountainous areas in the state. The eastern and western regions are an extension of the Appalachian highlands of the U.S.

The southern coast line along the Atlantic Ocean stretches from the extreme east at Point Judith to the extreme west at Napatree Point. Block Island, belonging to Rhode Island, is off this coast. The western boundary is separated in part from Connecticut by the Pawcatuck River, which empties into Little Narragansett Bay.

Among the state's points of interest are the birthplace of the painter Gilbert Stuart, near Saunterstown; and the homestead of Gen. Nathanael Greene of Revolutionary War fame, at Coventry. Butts Hill Ft., near Portsmouth, is the site of Rhode Island's only land battle in the Revolutionary War. The Old Slater Mill in Pawtucket, now a museum, is an industrial milestone; built by Samuel Slater in 1793, it was the first successful textile mill in the U.S. At Newport, once the summer retreat of millionaires and still a popular summer colony, are the sumptuous estates of a bygone era; some of the mansions are open to the public. Also in Newport is the White Horse Tavern, one of the oldest inns in the country, still in operation. The oldest Jewish synagogue in America, built at Newport in 1759, is an impressive example of colonial religious architecture; it is now the Touro Synagogue National Historic Site. Other colonial churches are the Seventh Day Baptist Church and Trinity Church, Newport; the First Baptist

ANNUAL STATE EVENTS

Horse Racing	March through November; Narragansett Park and Lincoln Downs
Heritage Week	First week in May; statewide
Horse Shows	May through September; various towns
Music Week Festival	Second week in May; Providence
Regattas	June through August; Narragansett Bay Yachting Assn.
Motor Festival	Last week in June; Newport; antique and modern cars
Jazz Festival	First week in July; Newport
Long Distance Overnight Yacht Race	July; Cranston
U.S. Atlantic Tuna Tournament	Mid-August; often based at Galilee, Narragansett
King and Astor Cup Races	Third week in August; Newport



Courtesy Rhode Island Development Council

NARRAGANSETT BAY

Yachts of all classes stage regattas here

Church in Providence was founded by Roger Williams in 1683 and dedicated in 1775.

Climate: The state has a relatively mild climate, but sudden changes in weather are not uncommon. The southern lowland area usually experiences a milder climate than the rest of the state; it also receives more rain.

Normal temperature, Providence	
January	30.3° F.
July	73.5° F.
Annual mean	51.4° F.
Latest Frost, Providence	April 24
Earliest Frost, Providence	Oct. 3
Precipitation, Providence	
January	3.7 in.
July	3.1 in.
Annual	38.63 in.
Average growing season	162 days

NATURAL RESOURCES

Water is Rhode Island's outstanding natural resource. Billions of gallons of water from the many swift streams and rivers are still used for power by the textile mills, in preference to steam or electricity. Water is also important in providing commercial shipping facilities, valuable fisheries, and recreation areas. Fisheries yielded a catch valued at more than \$4,600,000 in 1957.

Although forests cover more than 60 per cent of its area, Rhode Island produces very little commercial timber. The state has very small mineral deposits, among which stone, sand and gravel, and graphite are the most valuable. The principal mineral is granite, quarried in the southeastern part of the state near Westerly and Bradford.

RHODE ISLAND'S ECONOMY

Rhode Island has more industries for its size than any other state, and manufacturing is its largest employer. In 1950, 44 per cent of the state's 304,487 employed workers were engaged in manufacturing, against 24 per cent for the U.S. as a whole; the textile industry employed the greatest number. Other industries employing large groups of workers were the metal trades, jewelry and silverware production, and the rubber industry. Rhode Island is said to be the world's costume-jewelry center. The total value

RHODE ISLAND

added by manufacture in 1957 was \$762,000,000.

Ranking second to manufacturing as an employer in 1950 was wholesale and retail trade, accounting for 18 per cent of the labor force. Professional services ranked third in this category, employing about 3 per cent of the labor force.

Agriculture plays a minor role in Rhode Island's economy, ranking tenth in number of persons employed, and has been reduced essentially to dairying, poultry raising, and truck farming. In 1954 there were 2,004 farms. Total acreage was 155,000 acres, with 77.2 acres the average per farm. More than half the state's total cash farm income is derived from livestock and livestock products, chiefly eggs and commercial broilers. The leading crops are potatoes and truck-garden produce. Cash income from crops, livestock, and government payments was \$21,267,000 in 1957.

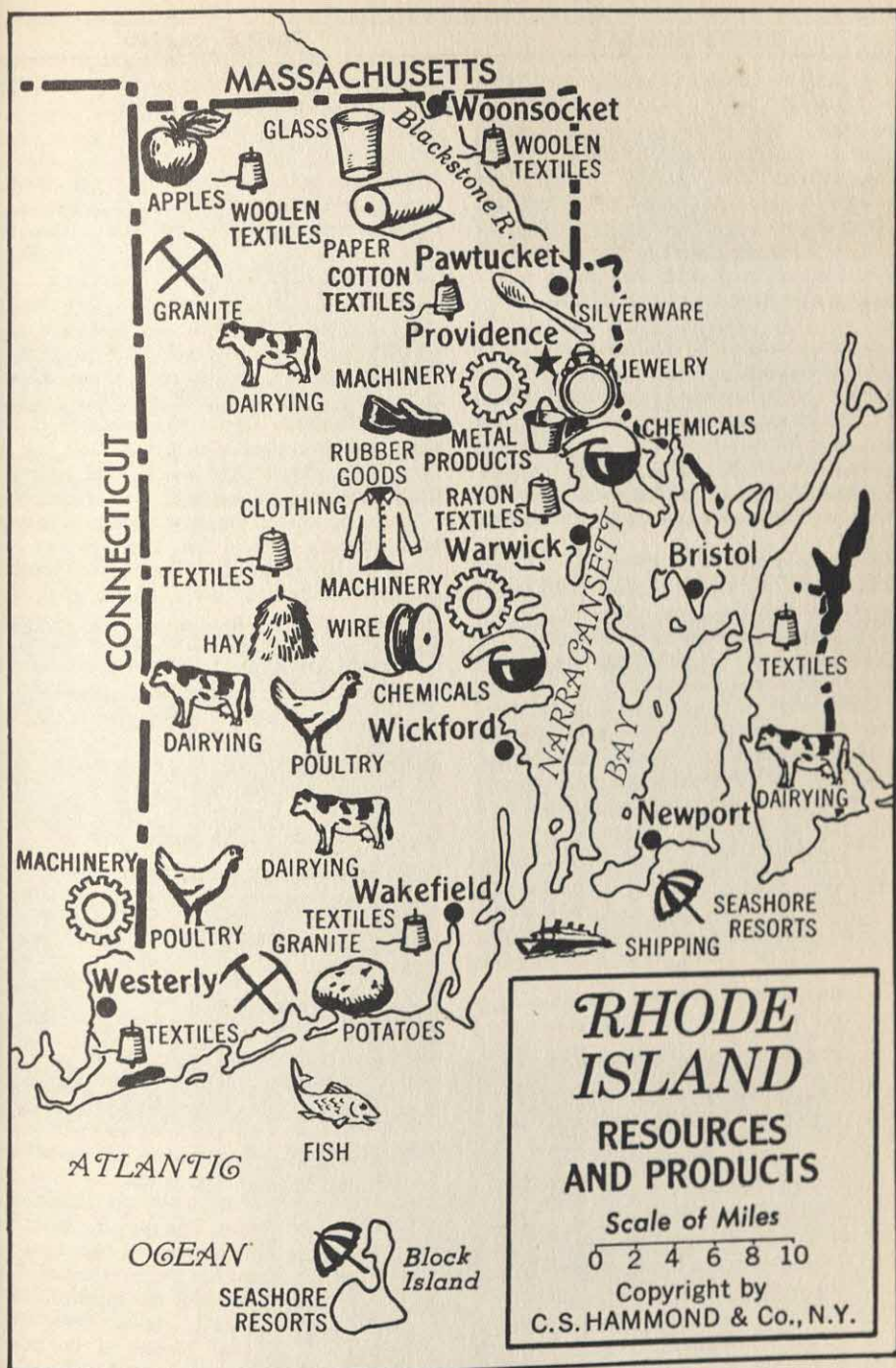
In 1956 Rhode Island ranked 49th in mineral production; its output was valued at \$1,369,000, representing less than 1 per cent of total U.S. production.

TRANSPORTATION AND COMMUNICATION

In addition to the main port of entry at Providence, there are nine smaller ports, including Newport, Pawtucket, and Bristol. The first railroad to operate in the state was the Boston & Providence R.R. (1835), now part of the New York, New Haven & Hartford R.R. The latter is the principal railroad in Rhode Island; there are also three short lines. Total railroad mileage in 1956 was 185 m. In 1957 the state had 4,167 m. of roads, of which 3,758 m. were surfaced. Major airlines operate out of the large cities. In 1957 there were 20 radio stations and two television stations. The first newspaper was the *Rhode Island Gazette*, published in Newport in 1732 by James Franklin, brother of Benjamin Franklin. The *Mercury and News*, a weekly published at Newport, is the oldest (1758) extant paper in the state. Among today's leading papers are the *Providence Bulletin* and the *Providence Journal*, the oldest daily (1829).

POPULATION

Rhode Island has five counties (for judicial purposes only). The state is preponderantly urban and has the fourth-largest urban population (proportionately) in the country, in 1950 comprising 84.3 per cent of the state's total population; the rural population comprised 15.7 per cent. Between 1940 and 1950 the urban population rose 7.2 per cent over that of 1940. The rural population rose by 52.6 per cent. More than half of the state's population resides in Providence; and this city's metropolitan area accounts for 93 per cent of the state's total popula-



tion. Rhode Island's population was estimated at 875,000 on July 1, 1958. In 1950 white persons numbered 777,015; of these, 663,751 were native born and 113,264 were foreign born. Non-white persons totaled 14,881; out of this group 13,903 were Negroes, with the remainder in-

cluding Chinese, Japanese, and others. Population density averaged 748.5 per sq. m. in 1950, the highest concentration in the U.S.

The major religious faiths, in order of size, in 1950 were the Roman Catholic and the Protestant, with a sizable Jewish group. The

predominant Protestant bodies were the Protestant Episcopal Church, the American Baptist Convention, the Congregational Christian Churches, and The Methodist Church.

Chief Cities: Providence, at the head of Narragansett Bay, is the capital and largest city of the state and its industrial and educational center; it is also an important port of entry.

Pawtucket, 4 m. n.e. of Providence at the mouth of the Blackstone River, is the second-largest city and a manufacturing center.

Cranston, south of Providence, is third in size and an industrial city.

Newport, at the mouth of Narragansett Bay, was one of the capitals of the state until 1900; it is today an internationally known summer resort and naval base. It also has large fishery interests.

Woonsocket, 16 m. n.w. of Providence on the Blackstone River, is an important manufacturer of textiles.

Famous Men and Women: Aldrich, Nelson Wilmarth (1841-1915), U.S. Senator (1881-1911), who helped draft the Payne-Aldrich Tariff Act and the Aldrich-Vreeland Currency Act of 1908.

Brown, Nicholas (1769-1841), businessman who helped fix the seat of Brown Univ., bearing his family name, at Providence. His son, John Carter Brown (1797-1874), collected the famous library that carries his name at the university.

Burnside, Ambrose Everett (1824-81), Indiana-born army officer, the only general from New England in the Civil War; inventor of the Burnside breech-loading rifle; governor of Rhode Island (1866-69); U.S. Senator (1875-81).

Doyle, Sarah Elizabeth (1830-1922), advocate of higher education for women, who helped establish the Rhode Island School of Design and Pembroke Coll.

Gorham, Jabez (1792-1869), first silversmith to use machinery.

Greene, Nathanael (1742-86), army officer appointed second in command to Gen. George Washington during the Revolutionary War.

Hopkins, Stephen (1707-85), variously officer, governor, and chief justice of the Rhode Island colony; signer of the Declaration of Independence and leader against British taxation.

Perry, Oliver Hazard (1785-1819), naval officer renowned for his words, "We have met the enemy and they are ours," announcing victory at Lake Erie during the War of 1812. His brother, Matthew Calbraith Perry (1794-1858), also a naval officer, negotiated a treaty with Japan (1854) opening the Orient to the West.

Slater, Samuel (1768-1835), English-born businessman who set up the first successful cotton-spinning machinery at Pawtucket (1790); considered the founder of the American cotton industry.

Thurston, Benjamin Francis (1829-90), promi-

nent attorney, who represented Thomas A. Edison and other notables.

EDUCATION

Education is free and compulsory for children between seven and 16. The state's public-school system was established in 1828. Public-school enrollment totaled 125,300 in 1956. State-supported institutions of higher learning are the Rhode Island Coll. of Education, Providence; and the Univ. of Rhode Island, Kingston, with a college of pharmacy and allied sciences at Providence. Private or denominational colleges include Brown Univ., Providence Coll., Bryant Coll. of Business, Rhode Island School of Design, and Providence-Barrington Coll., all in Providence; Roger Williams Jr. Coll., Greater Providence; and Salve-Regina Coll., Newport.

The museums of the state contain many exhibits of early colonial life. The Newport Historical Society is noted for its marine museum; extensive exhibits of silver, china, glass, and furniture; and a large 17th- and 18th-century library. The Rhode Island Historical Society at Providence has original 18th-century furniture. The Museum of Art of the Rhode Island School of Design, Providence, has important collections of classical and 19th-century paintings, small groups of primitive art, and collections of 18th-century American furniture, porcelains, and textiles. The South County Museum in Exeter exhibits early farm implements and tools.

GOVERNMENT

Rhode Island is governed under provisions of a constitution dating from 1842 and amended many times. The constitution gives executive power to a governor, lieutenant governor, secretary of state, attorney general, and general treasurer, all elected for terms of two years. A state board of education is appointed by the governor for a seven-year term, and it in turn appoints a commissioner of education. The legislature consists of a senate of 44 members and a house of representatives of 100 members, all elected for two-year terms. The legislature convenes for regular sessions in Providence, the capital city, in January of each year. The supreme court has five members (a chief justice and four associate justices), who serve for life unless removed. The judicial system also includes the superior court, 12 district courts, juvenile courts, town councils, probate courts, and justices of the peace. Rhode Island is represented in the U.S. Congress by two Senators and two Representatives.

HISTORY

Rhode Island's shores were supposedly explored by the Norsemen ca. A.D. 1000; by Giovanni da Verrazano, an Italian navigator, in 1524; and



NEWPORT'S NORSE TOWER

Some think the Old Stone Mill was built by the Vikings; others believe it is a colonial structure



NEWPORT'S QUAKER MEETING HOUSE (1699)

Guarantees of religious freedom attracted many dissenting groups (*courtesy Ewing Galloway, N.Y.*)



CARRIE TOWER (1904)

Paul Bajnotti of Italy presented this lofty tower to Brown Univ. in honor of his wife and of the college's tradition of free inquiry (*courtesy R.I. Development Council*)

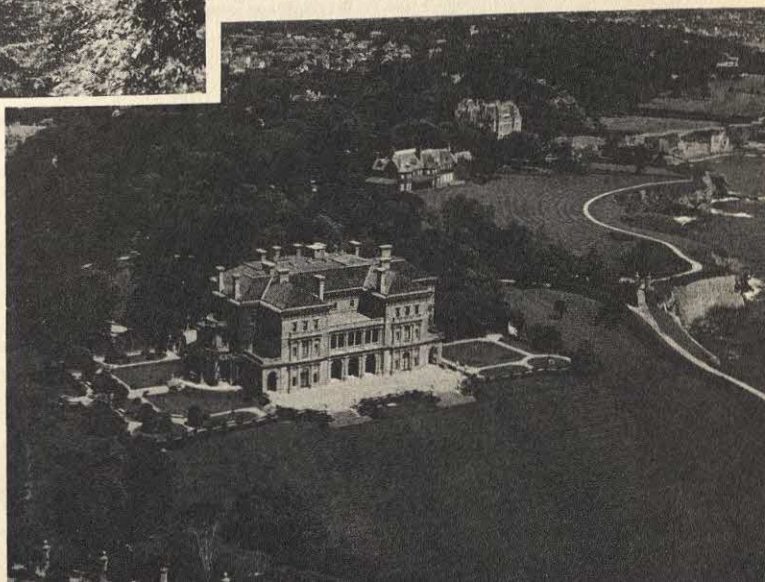
CORNELIUS VANDERBILT'S MANSION

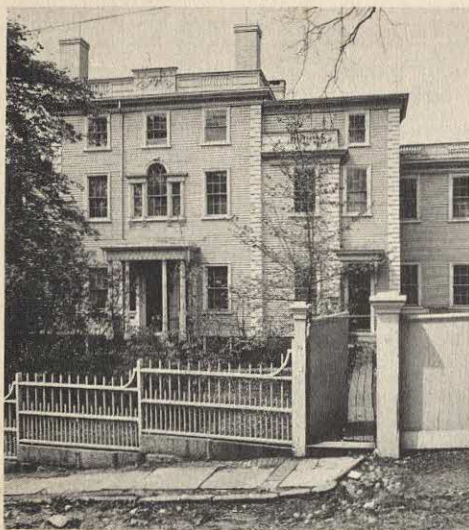
"The Breakers," built in 1895, is a show place of Newport's history as an exclusive resort (*courtesy Newport Publicity Service*)



JEWELER'S TOOL ROOM

Jewelry-making is among the state's principal industries (*courtesy Speidel Corp.*)





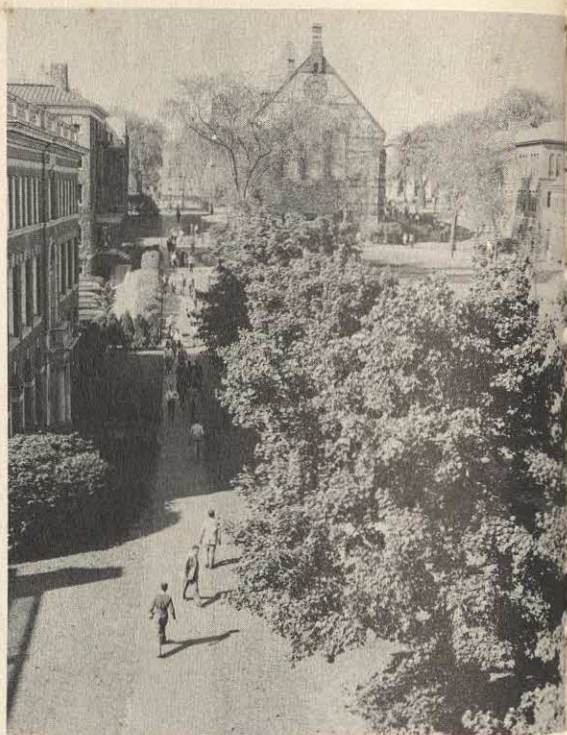
Courtesy Ewing Galloway, N.Y.

PROVIDENCE

Home of Thomas W. Dorr, built in 1809

in 1614 by the Dutchman Adriaen Block, after whom Block Island was named.

The first white settlement was established in 1636 by Roger Williams, a Salem pastor, at Providence, so named by him in thanks for his good fortune at finding a political and religious refuge from persecution in the Massachusetts Bay Colony. Two years later, in the spring of 1638, a group of religious dissenters led by Anne Hutchinson fled the Bay Colony, purchased the island of Aquidneck from the Indians, and settled at Portsmouth. Subsequent schisms led to the founding of Newport and Warwick, but religious tolerance prevailed. In 1644 the separate settlements united as Providence Plantations, and in 1663 they became Rhode Island and



Courtesy Brown Univ., Providence, R.I.

BROWN UNIVERSITY

The picture shows a scene on the lower campus at Providence

Providence Plantations, still the official title of the state. Newport and Providence shared the position of state capital until about 1900.

During colonial days, Newport flourished as a shipping and commercial center. It was here that revolutionary sentiment toward England was fired with the proclamation of the Sugar

MAJOR RECREATIONAL AND HISTORIC FEATURES

Name and Type	Size and Location	Points of Interest
Arcadia State Park (established 1945)	55 acres, in Arcadia (State 3, 165)	Beach; picnicking; pond
Beach Pond State Park (established 1945)	1,000 acres, near Escoheag (State 165)	Bathing beach; picnicking
Block Island State Park (established 1954)	18 acres on Block Island (ferry from Point Judith; steamer from Newport or ferry from New London, Conn., (summer only)	Surf bathing; recreation and picnic areas
Burlingame State Park (established 1938)	3,100 acres, near Charlestown (U.S. 1; State 2)	Wooded recreational area; Kimball Bird Sanctuary
Diamond Hill State Park (established 1938)	373 acres, in the northeast, near Woonsocket (State 114, 122)	Winter sports
East Matunuck State Beach (established 1956)	109 acres, on Block Island Sound (off U.S. 1)	Surf bathing; picnic area
Goddard Memorial State Park (established 1928)	472 acres, on Narragansett Bay, near East Greenwich (off U.S. 1)	Bathing beach; recreational facilities
Lincoln Woods State Park (established 1916)	638 acres, at Lincoln, north of Providence (State 146)	Historic sites; recreational facilities
Sand Hill Cove State Beach (established 1946)	27 acres, on Rhode Island Sound (off U.S. 1)	Salt-water bathing; recreation and picnic areas
Scarborough State Beach (established 1945)	24 acres, near Narragansett (off U.S. 1)	Beach; recreational facilities



Courtesy Rhode Island Development Council

BIRTHPLACE OF GILBERT STUART

A view of the sitting room in the colonial house, built in 1751, in North Kingstown, R.I. Stuart, who lived outside of Rhode Island for most of his adult life, was a famous painter of portraits of George Washington

Act of 1764. This law hit hard at the very profitable slave trade conducted by Newport, which took cargoes of rum to Africa, traded these for Negro slaves, then sailed to the West Indies to exchange the slaves for sugar and molasses with which to make more rum. On May 14, 1776, Rhode Island became one of the first states to declare its independence from England. However, fearing large commercial losses, it was the last of the 13 original states to ratify the Constitution (May 29, 1790).

Rhode Island played an important role in the Revolutionary War, particularly in helping to organize the Continental Navy, with Esek Hopkins, a native son, as first commander. After the war, the character of the state's economy changed from agricultural and commercial to industrial, spurred by Samuel Slater's textile mill, built at Pawtucket in 1793.

The War of 1812 was unpopular with Rhode Islanders, who greatly feared invasion. Troops were kept on the alert, however, and were called out frequently at the appearance of British ships offshore. Oliver Hazard Perry, a native son, became the hero of Lake Erie during this conflict by capturing the British squadron and thereby establishing control of the Great Lakes.

Boundary lines created problems for many years, but by 1899 the western, eastern, and

northern boundaries had been settled with Connecticut and Massachusetts.

A protest against unequal voting restrictions culminated in Dorr's Rebellion in 1842, led by Thomas Wilson Dorr, a lawyer and politician of Providence. Although the rebellion failed, the state's constitution was revised the following year and by 1888 all male citizens over 21 had the right to vote (although the franchise was still limited in that only property holders could vote on financial matters or for financial officers). Inequalities in the voting system continued into the 20th century.

Rhode Island sent 28,116 personnel into military service during World War I. In 1920 women voted for the first time. Other progressive legislation includes the abolition of capital punishment and adoption of workmen's compensation and unemployment laws. During World War II, 93,104 men and women from Rhode Island joined the armed forces, and Newport was an important naval station.

Rhode Island's urban population has almost doubled since 1900, as industry has become increasingly important in the state's economy. The manufacture of cotton, wool, and silk fabrics remains the state's chief industry, while agriculture plays a relatively unimportant role.

See also separate entries on most of the in-



Courtesy Rhode Island Development Council

RHODE ISLAND MILITIA

The Kentish Guards Artillery Company was chartered before the Revolutionary War

dividuals and geographical and historical subjects mentioned in this article.

Rhode Island, UNIVERSITY OF, a coeducational state institution of higher learning at Kingston, R.I., founded in 1892. It comprises the colleges of agriculture, arts and sciences, business administration, engineering, home economics, and pharmacy, and the school of nursing. Adult education centers are maintained in six other Rhode Island communities. The library has more than 300,000 volumes. Annual student enrollment totals ca. 3,000, and there are some 300 members of the faculty. The physical plant is valued at \$15,000,000.

Rhodes (*rôds*), an island, largest in the Aegean Sea, in the Dodecanese group of Greece. It is ca. 45 m. long, with a maximum width of 22 m. and an area of 545 sq. m. The island is mountainous along its entire length, and there is a fertile coastal strip which produces oranges, figs, pomegranates, grapes, wheat, olives, and vegetables. Besides agriculture, cattle raising, fishing, and sponge diving are important industries. The capital and chief seaport is Rhodes (pop. 1951, 23,599), situated on the island's northern tip.

Archaeological findings dating from the late Minoan civilization (q.v.) indicate that Rhodes shared in early Aegean civilization. In 1000 B.C. it was occupied by the Dorians, who established three city states. After being independent until the 6th century B.C., Rhodes came successively under the control of the Persians, the Athenians, and the Macedonians. Regaining its independence after the death of Alexander the Great (323 B.C.), it became a leading commercial power in Levantine trade and enjoyed great prosperity and

RHODES

a flourishing of art, science, and literature. A symbol of its greatness, the famous Colossus (q.v.) of Rhodes stood at the entrance to the harbor.

As an ally and province of Rome, Rhodes eventually came under the Byzantines and so remained until the fall of the empire in the 13th century. In 1309 Rhodes was taken by the Knights Hospitalers of St. John, who built up the modern city of Rhodes, defended the island against repeated attacks by the Ottoman sultans, and eventually yielded it to them in 1522. Neglected by the Turks, the island came under Italian control in 1912 and was ceded to Greece in 1945. Population, ca. 62,000.

Rhodes, CECIL JOHN, financier and British empire builder, born in Bishop Stortford, Hertfordshire, England, July 5, 1853; died in Capetown, South Africa, March 26, 1902. He was the son of a vicar of the Anglican Church. Rhodes' higher education was frequently interrupted by travels to South Africa because of ill health, but he was finally graduated from Oxford in 1881. Meanwhile, he had begun to lay the foundation of his fortune by helping in the development of the rich diamond mines at Kimberley, Cape Province. He went to South Africa again in 1881, intending to extend British influence in this region. He devoted his considerable energies almost exclusively to this goal and as a first step became a member of the Cape assembly in 1881. He was instrumental in the taking over of Bechuanaland by the British and or-

CECIL JOHN RHODES

Courtesy Brown Brothers, N.Y.



ganized the British South Africa Co. (ca. 1889), which took over Matabeleland and laid the basis for the establishment of Rhodesia. He was prime minister of Cape Colony (1890-95), but the Jameson Raid ended his political career (see *Jameson, Leander S.*).

Rhodes, although autocratic in his attitude and demands, was a respected leader who played a more than important part in furthering British interests in Africa. See also *Rhodes Scholarships*.

Rhodesia and Nyasaland (*rō-dē'zhā ānd nī-āf'g-lānd*), FEDERATION OF, an internally self-governing territory, within the (British) Commonwealth of Nations. Located in south central Africa, the federation is composed of the protectorates of Northern Rhodesia and Nyasaland and the internally self-governing territory of Southern Rhodesia. The total area is ca. 486,700 sq. m. The federation is bounded on the n. by the Congo Republic (Léopoldville) and Tanganyika, on the e. by Mozambique, on the s. by the Republic of South Africa and Bechuanaland, and on the w. by Angola.

The territories have similar climates and terrains. The country is mostly high plateau, averaging 3,000 to 4,000 ft. above sea level; the highest point is ca. 10,000 ft., at the southern tip of Nyasaland. The climate is moderate, with two seasons, the dry and the rainy, varying with the altitude. The river valleys, including those of the Zambezi, Limpopo, Kafue, Shire, Luangwa, and others, are usually hotter and wetter than the high plateaus. The Victoria Falls are formed by the Zambezi near Livingstone, and Lake Nyasa forms the greater part of Nyasaland's eastern boundary. The vegetation is largely savannah grass, with some areas of evergreen forest and hardwoods.

The economies of the territories are complementary. Corn and tobacco are grown in Northern Rhodesia, which mines copper, lead, cobalt, and zinc; Southern Rhodesia mines asbestos, gold, chrome, and coal, grows tobacco and citrus fruits, and produces dairy products; Nyasaland has few minerals but grows tea, rice, cotton, and tobacco. Southern Rhodesia produces clothing and textile fibers; Northern Rhodesia refines its copper. The main exports are metals, especially copper, and tobacco; the major imports are machinery and other manufactured goods.

There are some 3,000 route-miles of railroads in the Rhodesias and 500 m. in Nyasaland. There are over 62,000 m. of roads; major airports are located at Livingstone, Lusaka, and Salisbury.

Population in 1960 (est.) totaled 8,330,000, with the following breakdown:

TERRITORY	EUROPEANS	AFRICANS	OTHERS
Southern Rhodesia	221,000	2,830,000	16,300
Northern Rhodesia	76,000	2,340,000	10,300
Nyasaland	9,300	2,510,000	12,800

The large African populations are of Bantu origin; they include Matabele, Mashona, Angoni, and Barotse. The Africans are currently protected by the British and enjoy limited civil rights. They are employed in the mines, on the plantations, and in other laboring capacities. Those still living under tribal conditions are somewhat primitive agriculturists. Major cities include the territorial capitals and Blantyre, Bulawayo, and Livingstone. Education is provided on the elementary and secondary levels, but higher education has not yet been established.

The government is complex. There is a federal legislature and one in Southern Rhodesia. The federal government is headed by a prime minister and cabinet, and Southern Rhodesia has its counterparts; both governments are seated in Salisbury, the federal capital. Northern Rhodesia (capital, Lusaka) and Nyasaland (capital, Zomba) are governed through executive and legislative councils. A governor general heads the federation, and there are individual territorial governors. The federal supreme court is the court of appeal. Europeans control the governments, with limited African representation.

The federation originated in the mid-19th century, with the explorations of David Livingstone (*q.v.*). Cecil Rhodes' British South Africa Co. and its mining concessions opened up the territory and led to the setting up of British protectorates. Nyasaland became a protectorate in 1891; Northern Rhodesia became a unit in 1911 and a protectorate in 1924. Southern Rhodesia adopted a constitution providing for self-government short of dominion status in 1923. The federation of the three territories, first suggested in 1938, was delayed by World War II. Through the consultative Central African Council, established in 1945, it was finally achieved in 1953. There is still a great deal of dissatisfaction, however, particularly in Nyasaland, which would like to be independent.

Rhodesian Man (*rō-dē'zhī-ən mən*), fossil remains of a prehistoric man, discovered in the Broken Hill Mine, Northern Rhodesia, 1931. The body structure indicates that he must have belonged to the same period as the Neanderthal Man (*q.v.*). While the latter predominated in Europe, Rhodesian man probably lived in Africa. He was tall and heavy, with a primitive skull having small brain space and gorilla-like features. The large teeth, quite human in aspect, also show the human weakness of extensive dental caries. See *Man; Prehistory*.

Rhodes Scholarships (*ro-dē'zhī-ən shī-pē*), the stipends established by the will of Cecil John Rhodes (*q.v.*) for the purpose of maintaining a certain number of students at Oxford Univ., England. It is stated in the will that "a good understanding between England, Germany, and

the U.S. will secure the peace of the world, and that educational relations form the strongest tie." The scholarships are distributed each year to 34 students in the British Empire (including Canada, Australia, New Zealand, South Africa, Newfoundland, Jamaica, Bermuda, Rhodesia and Malta); 32 more are given in the U.S. Under the original grant, five annual scholarships were awarded to Germany, but these were annulled in 1916 by Parliament. Scholarships for Americans were suspended in 1939 for the duration of World War II but were revived in 1946. For 1946 and 1947, 16 additional fellowships were to be granted over and above the normal number of 32 in order to make up for the temporary suspension during the war years. The age of eligibility is fixed between 19 and 25, and candidates must be citizens of the states or countries by which they are appointed. Candidates are chosen on the basis of scholarship and are named by committees appointed by the Rhodes trustees. All nominations are subject to the final approval of the trustees. The scholarships have a value of \$2,000 per year and are awarded for a term of three years.

Rhododendron (*rō-dō-dēn'drōn*), an extensive genus of shrubs of the heath family. The leaves are usually alternate and in some species are evergreen, and the flowers grow in clusters and are often variously colored. Many species are cultivated for ornament in Canada and the U.S. They grow wild along the Pacific coast and in the Allegheny Mts. Several species are native to Japan, China, Australia and South America. Various American species have been naturalized in Europe, where they are cultivated extensively in gardens and parks as flowering plants. Some species abound in the Alps, where they are known among the Germans as *Alpine roses*. The *great rhododendron*, which grows from 10 to 20 ft. high, is found in abundance in some of the southern states.



RHODODENDRONS

Courtesy U. S. Forest Service

Rhombus (*rōm'būs*), an equilateral parallelogram. Its area is equal to bh , or the product of the base b and the altitude or height h . The diagonals of a rhombus intersect perpendicularly and bisect each other. One-half the product of the lengths of the diagonals is also equal to the area of the rhombus. If all the angles of the rhombus are equal, it becomes a square.

Rhondda (*rōn'dā*), a municipality of Glamorganshire, Wales, N.W. of Cardiff. It lies in the picturesque Rhondda River valley, and developed as a steam-coal producing center about 1865. Population, ca. 113,000.

Rhone (*rōn*), a river of France, which rises in Switzerland. 20 m. S.W. of the source of the Vor-



Courtesy French Press & Information Service, N. Y.

THE PONT D'AVIGNON OVER THE RHONE RIVER

der Rhein. The beginning is in the Rhone glacier, about 7,548 ft. above sea level. From Lake Geneva, through which it passes, it takes a general southwesterly course to Lyons, where it makes a bold turn toward the south and enters the Gulf of Lyons by an extensive delta. The length is 500 m., the basin has an area of 37,500 sq. m., and 350 m. of its course are navigable. The Saône, Ain, Isère, and Durance are its principal tributaries. It is connected by canal with the Rhine, Loire, Seine, and Meuse Rivers.

Rhubarb (*rōō'bārb*), or *PIE PLANT*, a genus of plants cultivated for medicinal use and as a food. About 20 species have been described. The stems are erect and thick, often from 5 to 7 ft. high, and bear a cluster of seeds at the upper end. The roots are fleshy and the leafstalks, when

young and tender, are used for pies, tarts, preserves, and a kind of wine. In many countries the rhubarb is cultivated chiefly for its roots, owing to their medicinal properties. Rhubarb as a medicine is slightly astringent, when given in small doses, and in large doses acts as a purgative. It is used mostly in treating jaundice, catarrh of the biliary duct, and for certain skin diseases. The plant is cultivated for medicine in China and Russia. In Canada, the U.S., and nearly all countries having a temperate climate it is grown for food. The root winters in the ground in moderately cold climates, hence the young shoots appear early in the spring.

Rhyme (*rīm*), or RIME, a composition in verse, in which the terminating word or syllable of two or more lines correspond in sound. Poems differ in the degree of resemblance of the endings, but in strict rhyme it is required that the last stress vowels in the rhyming lines agree exactly, although the lines may differ in some respects. The words *rain*, *train*, and *strain* rhyme with each other, but *rain* and *reign*, though widely different in spelling, are sufficiently similar in sound to form good rhyme. From this it will be seen that rhyme is almost always governed by the sound instead of by spelling or meaning. In some poems each couplet, or two lines, rhyme, as in Whittier's "Maud Muller":

Maud Muller, on a summer's day,
Raked the meadow, sweet with hay.

This may be considered a simple style of forming rhymes, and productions written in this form are usually simple and clear in expression. In formal versification, the rhyme scheme is determined by the form of poem, *i.e.*, the sonnet (*q.v.*) has special and set rhyme patterns, as has the couplet. Poems are formed by the writers according to their taste in stanzaic structure, some lines rhyming only at the end and others forming complete rhymes at various intermediate places. The most common form of inner rhyme is alliteration (*q.v.*). Some writers either introduce a limited amount of alliteration or use it extensively. Rhymes at the end of the lines are ordinarily between two or more verses, and sometimes the style is alternated, as in Shelley's "Cloud":

I bring fresh *showers* for the thirsting *flowers*,
From the seas and the *streams*;
I bear light *shade* from the leaves when *laid*
In their noonday *dreams*.

The writers of ancient Greece and Rome did not make extensive use of rhymes, but this style of writing has been popular among the Arabs, Chinese, and other people of Asia from remote antiquity. Systematic rhyme came into use among the Romans in the time of Augustus, in the latter part of the 4th century, and was taken up in Western Europe with much eagerness during

the Reformation, when the writing of religious songs formed an important branch of literature. Some of these writers, as Milton, made extensive use of alliteration.

Four other rhyme devices are also used with frequency. They are assonance, consonance, eye rhyme, and "strained" rhyme. Although these devices have had common usage at various periods, modern English and American poets have experimented with them especially in an effort to produce irregular and heightened effects.

Assonance consists of the rhyming of one word with another in the accented and subsequent vowels, but not in the consonance. Characteristic of Old French verse and of many English ballads and folksongs, assonance also characterizes the work of such modern poets as Emily Dickinson.

In *consonance*, the consonant sounds following the vowels are identical, and the vowels are different. An outstanding modern instance of its use is in the writing of the British poet of World War I, Wilfred Owen.

In *eye rhyme*, the words rhyme according to spelling, but do not rhyme when pronounced.

Rialto (*rī-āl'tō*), THE, one of the landmarks of Venice, Italy, a marble bridge spanning the Grand Canal. It is 74 ft. long and 32 ft. high. Construction was begun in 1588 and completed about 1591. Shakespeare has made it familiar by mentioning the bridge and the nearby district in his "Merchant of Venice."

Ribbentrop (*rīb'en-trōp*), JOACHIM VON, diplomat, born in Wesel, Germany, 1893; died Oct. 15, 1946. After serving in the German army during World War I, Von Ribbentrop devoted himself to his successful wine business until 1930, when he associated himself with Adolf Hitler's National Socialist movement. He was appointed ambassador at large (1935), in which capacity he represented Germany in formulating the Anglo-German naval agreement of 1935. In 1936, he became German ambassador to Great Britain but was recalled from London to become minister of foreign affairs (1938). He was instrumental in negotiating the German-Japanese anti-Comintern agreement (1936), the Russo-German non-aggression pact (1939), and the Italo-German-Japanese alliance (1940). He was indicted as a war criminal (1945) for his strong influence upon Hitler's decision to attack Poland (Sept. 1939) and was executed after being sentenced to death by the International Military Tribunal at Nuremberg. See *Nuremberg Trial*.

Ribbon Fish (*rīb'n fish*), the name of several fishes found in the deep waters of all the oceans. The body is long and compressed like a tape, while the head is short and the mouth is narrow. On the back is a long and high dorsal fin. The anal fin is absent, while the caudal fin

is either absent or but slightly developed. Three families of these fishes have been described, but each is represented by only a few species. The skin is naked and silvery, and the entire structure is delicate in nearly all these fishes. Some specimens are from 12 to 20 ft. long, but the thickness rarely exceeds 2 in. They are not very numerous in any locality but are found widely distributed from the polar to the tropical seas. A fish common to the Gulf of Mexico and the West Indies is known by the same name, in reference to the dark brown bands that characterize its body.

Ribéra (*rê-bâ'ra*), JOSÉ (GIUSEPPE), called in Italy *Lo Spagnoletto*, Spanish painter and etcher, born near Valencia, Spain, Jan. 12, 1588; died in Naples, Italy, Sept. 12, 1652. A pupil of the Spanish painter Francisco Ribalta, and influenced by Corregio and Caravaggio, he settled in Naples in 1616 and became court painter of the Spanish viceroy there. One of the great Spanish colorists, Ribéra became a leader of the Neapolitan school.

His works include "Martyrdom of St. Bartholomew" (1630), "Pietà" (1637), "St. Agnes" (1641), and "The Descent from the Cross" (1644).

Ribicoff (*ri'bî-kôf*), ABRAHAM ALEXANDER, politician, born in New Britain, Conn., April 9, 1910. After he was graduated from the Univ. of Chicago (1933), Ribicoff practiced law in Hartford, Conn., and then was an assemblyman (1939-42). He was a Hartford police-court judge (1941-43, 1945-47) and a Democratic member of Congress (1950-53). Although defeated in a 1952 bid for the U.S. Senate, two years later Ribicoff was elected governor of Connecticut. He gained great popularity and in 1958 was re-elected with the largest plurality in the state's history (ca. 246,000 votes). His administration became noted for a strict highway-safety program and for court reform. A pre-election supporter of Sen. John F. Kennedy, Ribicoff was named Secretary of Health, Education, and Welfare in 1961, but resigned in 1962 to campaign successfully for the U.S. Senate.

Riboflavin (*ri'bô-flâ'vîn*). See *Vitamins*.

Ribot (*rê-bô'*), THÉODULE ARMAND, psychologist, born in Guingamp, France, Dec. 18, 1839; died Dec. 9, 1916. He was educated at the École Normale, Paris, receiving a doctor's degree in 1875. For some years he was professor in the former institution, and in 1885 he was given the chair of experimental psychology at the Sorbonne. Later he was professor of experimental and comparative psychology in the Coll. of France and much of his time was given to the investigation of psychology at the histological and physiological laboratories. He was a leader in developing interest in the study of psychology in France and was the founder of the *Revue philosophique*.

Ribs (*ribz*), the elastic arches of bone which

constitute the larger part of the walls of the chest. Man has 24 ribs, 12 on each side of the chest. At the back they are attached to the spine. Seven pairs are tied by cartilages to the breastbone or sternum, in front, three are fastened to each other and to the cartilage above, and two are loose, or floating ribs. The first seven pairs are known as *true*, or *vertebrosternal* ribs, and the others are designated as *false ribs*. The name intercostal spaces is applied to the spaces between the ribs. In respiration the ribs have more or less complex movement. A contraction of the seven upper intercostals causes the sternal end to be elevated and carried forward, causing the diameter of the chest to be increased. The natural form of the chest is that of a cone diminishing upward, which, when the clothing is not too tight, gives the greatest freedom of motion in respiration.

Ricardo (*ri-kâr'dô*), DAVID, economist and statesman, born in London, England, April 19, 1772; died in Gloucestershire, Sept. 11, 1823. He was descended from Jewish parents and entered his father's business as a stockbroker. The two became alienated because the son married a Christian and accepted the Christian faith, but young Ricardo established himself as a stockbroker, realizing a large fortune by means of business investments. In 1819 he became a member of Parliament and retained his seat until his death. He was a student of geology, chemistry, and, especially, political economy, published a number of books, and made a series of contributions to the *Morning Chronicle*. His most noteworthy publications are "The High Price of Bullion a Proof of the Depreciation of Bank Notes," which appeared in 1809, and in which he discussed the means and possibility of determining the value of paper currency; and "Principles of Political Economy and Taxation" (1817), in which he examined the economic meaning of rent, profit, and wages.

Rice (*ris*), an annual cereal plant native to India, but now extensively naturalized and cultivated for its seed. Many writers assert that rice was cultivated in China about 2822 B.C.; in the Euphrates valley, about 400 B.C.; and near Pisa, Italy, as early as A.D. 468. It constitutes one of the most important foods and is used more extensively than any other foodstuff by the people of the world, being the principal food of nearly one-third of the human race. Several thousand species have been enumerated. Some are grown on upland, but most of the rice sold in the market is tilled on marshy or inundated land, as in the swamps of the Carolinas, Louisiana, and Texas, and in the Nile and Niger valleys. The seed is sown like oats or wheat, after which the ground is flooded until it germinates, when the water is drawn off. It is flooded a second time to kill the weeds and a third time when about

RICE

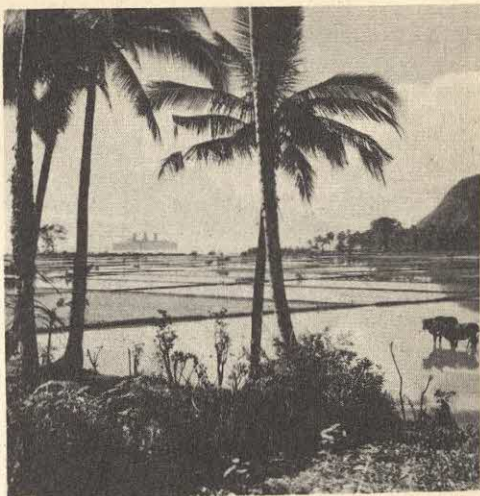
to head. In most regions the height of the plant depends principally upon the depth of the water, as the ear always grows above the surface, and the grain develops in heads like those of oats. The water is drawn off shortly before the grain ripens and the crop is cut with reapers and threshed by machines.

Each grain of rice is covered with a husk, when the seed comes from the threshing machine; in this condition it is known as *rough rice*, or *paddy*. The husk, or hull, is removed by a huller, the essential part of which consists of heavy millstones that revolve rapidly, but are not close enough together to break the kernels. Several grades of rice result from the process of removing the husk, as some of the grains are broken. The plan of cultivation and treatment varies somewhat in different countries, but in all cases moisture and a warm climate are essential to the production of the better grades. Asia produces more rice than all the other continents. The average yield is from 30 to 38 bushels per acre. Rice of the finest quality is produced in Georgia and the Carolinas. Rice is chiefly a farinaceous food and contains only about 7 per cent of gluten. It is most healthful when eaten with milk or fatty substances.

Rice, ALICE HEGAN, author, born in Shelbyville, Ky., Jan. 11, 1870; died in Louisville, Ky., Feb. 10, 1942. She was educated at Hampton Coll., Louisville, and began to write short stories at an early age. In 1902 she married CALE YOUNG RICE (1872-1943), an author and dramatist. Her writings are original in humor, and the characters are realistic. In 1901 she published "Mrs. Wiggs of the Cabbage Patch," which attained great popularity. Other writings include "Sandy," "Lovely Mary," "Mr. Pete & Co.," and "My Pillow Book."

Rice, ELMER, playwright, born in New York City, Sept. 28, 1892. The fact that Rice started his career as a lawyer rather than as a dramatist accounts for the power of his courtroom scenes for the stage. His first play, "On Trial," was produced in 1914, a year after he was admitted to the bar in New York State. Since then he has written a long series of successful dramas, including "Iron Cross" (1917), "For the Defense" (1919), "The Adding Machine" (1923), "Cock Robin" (1927), "Counsellor-at-Law" (1931), "We, the People" (1933), "Not for Children" (1936, revived 1951), "American Landscape" (1938), "Flight to the West" (1941), "A New Life" (1944), and "Dream Girl" (1945). He was awarded the Pulitzer Prize for "Street Scene" in 1929 (revived 1947 as a dramatic musical, with music by Kurt Weill, lyrics by Langston Hughes), and is the author of several novels, including "Imperial City" (1937).

Rice Paper (*rīs pā'pēr*), a product manufactured from the pith of the rice-paper tree (*Terra-*



RICE FIELD IN THE EAST INDIES



RICE FIELD ON THE ARKANSAS PRAIRIE

panax papyrifera), a plant native to Formosa. It is made extensively in China, whence it is exported in large quantities. Fine artificial flowers are made from rice paper, and it is also widely used for water-color paintings. Several varieties are used in printing decorated and presentation books.

Richard I (*rich'ērd*), King of England, sur-named the Lion-Hearted, born at Oxford, England, Sept. 8, 1157; slain near Châlus, France, April 6, 1199. He was the third son of Henry II and his queen, Eleanor, and on July 6, 1189, succeeded his father. During his youth he was the cause of a quarrel in the family of his father, and in 1184 sided with the King of France in a war against England. Shortly after ascending the English throne, he organized a large army and took part in the Third Crusade for the conquest of the Holy Land. His army joined the forces of



RICHARD I

Philip of France at Vezelai, whence the allied army of 100,000 men marched to Lyons, where they separated, but afterward met at Messina. Richard next sailed to Sicily, then to Cyprus, and on June 4, 1191, joined the Crusaders at Acre. This fortress had been besieged nearly two years, but soon after the arrival of Richard it surrendered, and he immediately began his march upon Jerusalem, but never ventured to make an attack upon the city. He accomplished nothing aside from the capture of Acre, and, after concluding a truce of three years with Saladin, commander of the Saracens, sailed for home, but was wrecked in the Adriatic Sea. Fearing discovery in Austria by his enemy, Duke Leopold, he undertook to pass through that country in disguise, but was discovered and surrendered to Henry VI, Emperor of Germany. He was at length liberated after imprisonment at Trifels and Worms, and in 1194 returned to England. Soon after he engaged in a war against Philip of France, in which he was killed.

Richard II, King of England, son of Edward the Black Prince, born at Bordeaux, France, Apr. 13, 1366; died at Langley, Scotland, Feb. 14, 1400. He succeeded his grandfather, Edward III, on the throne of England in 1377. As he was a minor, the government was vested in a council of 12, but his uncle, John of Gaunt, was excluded from the council. Excessive taxations and various abuses led to a peasants' revolt in 1381, which was headed by Wat Tyler, and in the factional contentions that followed, the young king showed considerable boldness and presence of mind.

In 1382 he married Anne of Bohemia, daughter of Emperor Charles IV, and in 1385 ended the war with France only to take up arms against Scotland. He declared his majority in 1389, thus freeing himself from the dictation of the council, but the weak king soon let the reins of government pass to the Duke of York, though the coun-

RICHARDS

try enjoyed several years of peace and a fair degree of prosperity. However, the queen died in 1394 and he soon after married Isabella of France. In 1397 he became entangled in a quarrel with Warwick, Gloucester, and Arundel, and when Parliament met all were declared guilty of treason. This resulted in the execution of Arundel, while Warwick was banished, and Gloucester died from violence in prison.

On the death of John of Gaunt, in 1399, Richard seized the Lancaster estates, and this unjust act brought about his downfall. While the king was in Ireland, the Duke of Hereford organized a force to regain the Lancaster estates, and succeeded in raising sufficient military power to force the king into submission on his return to England. Parliament, in 1399, deposed him, and on Sept. 29 he executed a deed resigning the crown to Henry. Though at first liberated, a month later Richard was sentenced to life imprisonment at Pontefract Castle. A conspiracy was discovered in 1400, against Henry IV, in which Richard was implicated, and his death soon after in prison is thought to have resulted from violence.

Richard III, King of England, last of the Plantagenet dynasty, born at Fotheringay, England, Oct. 2, 1452; died in battle at Bosworth, Aug. 21, 1485. He was the youngest son of Richard, Duke of York, and a brother of Edward IV. The latter succeeded his father as king of England, in 1460, and soon after created Richard Duke of Gloucester and made him lord high admiral, in which capacity he served the king with much fidelity. He married Anne, daughter of the Earl of Warwick, in 1473, and in 1482 commanded an army into Scotland against James III. Edward IV died in 1483 and left Richard as guardian to his son Edward V, then a youth of only 13 years. However, Richard at once began to make plans to acquire the throne of England, and accordingly placed Edward V and his younger brother in the Tower, while he had himself proclaimed King of England. The people soon organized a formidable insurrection against him, but he suppressed the uprising and executed the leaders. About the same time the two royal children were cruelly murdered in the Tower, it is thought with the knowledge of Richard. His reign was characterized by much cruelty and crime, which soon disgusted the people, and in 1485 Henry of Richmond landed in England as his rival for the throne. The two met in battle at Bosworth, where Richard was slain. This battle decided the War of the Roses and placed the house of Lancaster in power.

Richards (*rich'êrdz*), THEODORE WILLIAM, chemist, born Jan. 31, 1868, in Germantown, Pa.; died Apr. 2, 1928, in Cambridge, Mass. He was educated at Haverford Coll., Harvard Univ., and

the Univ. of Göttingen, Leipzig, and Dresden. After his return from Europe, he began to teach chemistry at Harvard, where he remained until his death. He was professor of chemistry from 1901, chairman of the chemistry department from 1903-11, and director of the Gibbs Memorial Laboratory from 1912. His most important work consisted of measuring exactly the atomic weights of 23 chemical elements, for which work he received the Nobel Prize for chemistry in 1914. Although the atomic weights of these elements had been determined before his time, they were in many cases not accurate and he was responsible not only for correcting that condition but for inventing techniques which made complete accuracy possible. During his later years he began working on problems in physical chemistry, particularly in the fields of thermochemistry, electrochemistry, and thermodynamics.

Richardson (*rich'erd-sūn*), HENRY HOBSON, American architect, born in Priestley's Point, La., Sept. 29, 1838; died at Boston, Mass., Apr. 27, 1886. After being graduated from Harvard Univ. in 1859, he studied architecture in Paris until 1865, when he returned to the U.S. and became a member of the firm of Gambrell & Richardson in New York City, in which partnership he stayed until 1878. Richardson may be said to have originated a particular style of architecture, leaning heavily on the Romanesque, and possessing elements of strength and refinement. He preferred to produce effect by mass rather than elaboration of decoration. Among the noteworthy structures planned by him are North Church, Springfield, Mass.; Brattle Street Church (now known as the First Baptist Church), Boston; Trinity Church in the same city; the Chamber of Commerce, Cincinnati; the Field Building, Chicago; and a number of halls at Harvard Univ.

Richardson, SIR OWEN WILLIAMS, physicist, born in Dewsbury, England, in 1879; died in Alton, Feb. 15, 1959. He studied at Cambridge Univ. and the Univ. of London. He was professor of physics at Princeton Univ. (1906-14) and at King's Coll., London (1914-24), where he directed research (1924-44). He won the 1928 Nobel Prize for his work on the effects of heat on matter (known as the "Richardson effect"), which was important for later developments in radio and television. He wrote "The Emission of Electricity from Hot Bodies" (1916) and "Molecular Hydrogen and Its Spectrum" (1933).

Richardson, SAMUEL, novelist, born in Derbyshire, England, in 1689; died in London, July 4, 1761. He was the son of a carpenter. At 15 he went to London as an apprentice printer, and later established his own office. He was known from his youth as a fluent letter writer, but he did not begin to write professionally until about 50 years old, when he became the discoverer of

a new literary form by accident. This occurred when a London firm wished to publish a series of model letters as a guide for letter writers, and he was selected as a suitable person to prepare such a work. He conceived the idea of making the letters tell a connected story and selected a country girl to represent the heroine, naming his production "Pamela, or Virtue Rewarded." This work was received with such favor that many editions were issued.

Richardson's second novel, entitled "History of Clarissa Harlowe," appeared in 1749. This work is generally regarded as his masterpiece. A few years later he published "History of Sir Charles Grandison." In these three works Richardson treated in an interesting manner as many different orders in the social scale. "Pamela" dealt with the lower class; "Clarissa Harlowe," with the middle class of society; while in "Sir Charles Grandison" he intended to represent an ideal hero, who would combine the graces and accomplishments of the man of fashion with the perfection of educational and religious culture. In 1754, he became the printer of the journals of the House of Commons.

Richardson, WILLIAM ADAMS, jurist and statesman, born in Tyngsborough, Mass., Nov. 2, 1821; died in Washington, D.C., Oct. 19, 1896. In 1846 he was graduated from Harvard Univ., and admitted to the bar in Boston. He soon became a prominent member of the bar, was named judge of probate for Middlesex County in 1856, and in 1869 was appointed Assistant Secretary of the Treasury by President Grant. In 1873 he became Secretary of the Treasury, but resigned to become judge of the court of claims in 1874. President Arthur appointed him chief justice of the court of claims in 1885. He served as trustee of Harvard and lecturer on law in the Georgetown Univ., D.C. His publications include "History of the Court of Claims" and "National Banking Laws."

Richelieu (*rēsh'ē-lōō*), ARMAND JEAN DU PLESSIS, CARDINAL, DUKE OF, statesman, born in Paris, France, Sept. 5, 1585; died Dec. 4, 1642. He was descended from a noble family and studied for a military career at the Coll. of Navarre, but his elder brother, being bishop of Luçon, influenced him to study for the church. Accordingly he attained a degree at the Sorbonne and in 1607 succeeded his brother as bishop of Luçon, being consecrated to that position by Cardinal de Givry in the presence of Pope Paul V. Louis XIII of France appointed him secretary of war and foreign affairs in 1616, but the following year Louis quarreled with the queen mother and Richelieu was banished to Blois and later to Avignon. A reconciliation was effected soon after and the queen was restored to her position at court, Richelieu gaining marked influence. He was made cardinal in 1622 and became minister



CARDINAL RICHELIEU

of state in 1624, a position which he retained until his death. It was Richelieu's design to strengthen the French court and with that end in view he devised a plan whereby the nobles and feudal lords were limited in power, many of the leading opponents being sentenced to life imprisonment or brought to the scaffold. This fairly begun, he began to plan with the view of weakening the house of Hapsburg, both in Germany and Italy.

He was instrumental in bringing Gustavus Adolphus into Germany as a champion of the Protestants in the Thirty Years' War, but only because he designed to humble the pride of Austria. Immediately after he undertook to suppress the Huguenots, which he accomplished in part in 1628 by capturing La Rochelle. When their influence became limited, he turned against the queen mother, Marie de Medicis, for the reason that she had conspired to cause his fall, whereupon she was compelled to withdraw into exile at Cologne. Richelieu was signally successful in carrying out his vigorous policy, both at home and abroad. He made his administration quite impressive by establishing many internal improvements and promoting gigantic military maneuvers. As a statesman he attained to much eminence, giving the royal house freedom from the influence of the nobility. He patronized learning and founded the French Acad. and the royal printing presses. In 1631 he was raised to the rank of duke. He is the author of several works on economics, civics, and diplomacy.

Richet (*rê-shâ*'), CHARLES ROBERT, physiologist, born Aug. 26, 1850, in Paris, France; died there Dec. 3, 1935. He was educated at the Lycée Bonaparte and at the medical school of the Univ. of Paris, from which he was graduated in 1876. In 1887, he became professor of physiology there, retaining that position until 1927.

For his best-known work, the discovery of the phenomenon which he called anaphylaxis, he received the Nobel Prize for physiology and medicine in 1913. Richet first used the term anaphylaxis in 1893, to describe the toxic reaction in men and animals which may follow the second injection of a foreign protein into the blood stream, as in the injection of horse serum to prevent diphtheria. In 1894, he discovered an anesthetic which could be used in vivisection experiments to kill pain without destroying the reflexes of the animal. In 1905, Richet served for a year as president of the London Society for Psychical Research, a subject in which he had taken an interest for many years. He also served at one time as president of the leading French peace society, the Society for Arbitration among Nations. He wrote numerous works on physiology and psychology, as well as two books on the subject of war and peace, a book of poems, and several works of fiction. He translated William Harvey's "Circulation of the Blood" into French.

Richmond (*rich'münd*), a city in Contra Costa County, California, located on the east shore of San Francisco Bay, about 9 m. n.w. of Oakland, Calif. It is served by the Atchison, Topeka and Santa Fe and the Southern Pacific R.R.'s. Richmond has a deep-water port and is an industrial center, with shipyards, railroad repair shops, an automobile assembly plant, and an oil refinery. Among other industries are metal working, canning, and production of chemicals and fish oil and meal. It was settled in 1899 and incorporated in 1905. Population, 1940, 23,642; in 1950, 99,545.

Richmond, county seat of Wayne County, Indiana, on the Whitewater River, 68 m. e. of Indianapolis. It is served by the Chesapeake and Ohio and the Pennsylvania R.R.'s. It is a center of a rich farming area which produces dairy products, grains, and vegetables. The industries of Richmond are varied, producing lawn mowers, caskets, machine tools, aircraft parts, bus bodies, phonograph records, and fireproof doors. It is also a center for producing greenhouse equipment and hothouse flowers, particularly roses. Its principal buildings include the Wayne County Historical Museum, Richmond State Hospital, Earlham Coll., and McGuire Memorial Hall. The city, settled in 1806 by the Quakers, was incorporated as a village in 1818 and chartered as a city in 1841. Population, 1940, 35,147; in 1950, 39,539.

Richmond, a borough of New York City. See *New York City; Staten Island*.

Richmond, capital of Virginia, situated on the James River. The city's corporate area covers 39.9 sq. m., but many of its suburbs lie beyond the city limits in Henrico and Chesterfield counties. As an inland port

RICHMOND

Richmond has facilities for ocean-going vessels and is also served by the Chesapeake and Ohio, the Atlantic Coast Line, the Richmond, Fredericksburg and Potomac, and other railroads. Byrd Airport is 9 m. E. of the city.

DESCRIPTION: Richmond, a storied city which has played a dramatic role in the history of the U.S., abounds in interesting old buildings and monuments. In Capitol Sq., one of the city's more than 60 parks and playgrounds, is the State Capitol, designed in 1785 by Thomas Jefferson after the Maison Carrée in Nîmes, France (wings were added in 1905). The State Capitol houses the oldest lawmaking body in the U.S., dating from July 30, 1619, when its first session was held in Jamestown, Va. The famous statue of George Washington by Jean Houdon (*q.v.*) graces the capitol. Among the many other historic landmarks are the John Marshall House, built in 1790 by the fourth chief justice of the U.S.; the Valentine Museum of the life and history of Richmond; Lee House, the home of Gen. Robert E. Lee's family during the last years of



VIRGINIA STATE CAPITOL

the Civil War; the Confederate Museum, the home (1862-65) of Confederate President Jefferson Davis; and Battle Abbey. On Monument Ave., looking west, are the noteworthy statues of J. E. B. Stuart, Robert E. Lee, Jefferson Davis, "Stonewall" Jackson, and Matthew Fontaine Maury. Other landmarks are the Hollywood Cemetery, where Presidents James Monroe and John Tyler and Confederate President Davis are buried; and Tredegar Iron Works, of Civil War fame (some of the old buildings are still standing below Gamble's Hill Park). The Poe Shrine, filled with relics associated with Edgar Allan Poe (*q.v.*), occupies the "Old Stone House," the oldest house in the city, which is believed to have been built in 1737. (An old stone in front of the house with the initials I R, assumed to stand for Jacobus Rex, James II of England, created the legend that the Old Stone House was built in 1686.)

Richmond, often called the "City of Churches," has 350 churches in the metropolitan area, among them St. John's Episcopal Church (1741), where Patrick Henry (*q.v.*) made his famous "Give



RICHMOND, VIRGINIA

St. John's Church, scene of Patrick Henry's "Liberty or Death" speech

me liberty or give me death" speech (1775); Monumental Episcopal Church, built in 1812 on the site of a theater fire (1811) in which 72 persons perished; and St. Paul's Episcopal Church, where Gen. Robert E. Lee and Confederate President Davis worshipped.

COMMERCE: Richmond is a financial center and headquarters of the Fifth Federal Reserve District. Tobacco has been the city's leading industry since its earliest days; other industries include printing and publishing, and the production of chemicals, foods, iron and steel, paper, apparel, and lumber and wood products. The Richmond standard metropolitan area, which includes the city of Richmond and Chesterfield and Henrico counties, had a value added by manufacture of \$343,916,000 in 1954; the figure for the city alone was \$285,599,000. Tourism yields more than \$9,000,000 annually.

EDUCATION AND CULTURAL FACILITIES: The city's public-school system enrolls more than 45,000 students annually; the parochial schools enroll *ca.* 6,000. Among the institutions of higher learning are the Medical Coll. of Virginia, Richmond Professional Inst., Union Theological Sem., Univ. of Richmond, and Virginia Union Univ. Cultural facilities include city and state libraries, the Virginia Museum of Fine Arts, and the Mosque (an auditorium with a seating capacity of 5,000), where the Richmond Symphony Orchestra, other concerts, plays, and various kinds of entertainment are presented.

GOVERNMENT: Richmond has had a council-manager form of government since 1948. The nine council members are elected for two-year terms, and the city manager is appointed by the council for an indefinite period.

HISTORY: In 1607, soon after arriving at Jamestown, Va., Capt. John Smith (*q.v.*) and his party sailed up to the Falls of the James River and planted a cross on an island below

what is now Gamble's Hill Park (end of South 3rd St.). In 1609 a settlement called Ft. West was started below what is now Libby Hill Park (29th and East Franklin Sts.), but floods and attacks by Indians prevented a permanent settlement until Ft. Charles was erected (1644) at the Falls of the James River. Colonel William Byrd founded the town in 1737, naming it Richmond after Richmond-on-the-Thames in England. It was incorporated as a town in 1742 and as a city in 1782. Richmond became the capital of Virginia in 1779 and in 1862-65 was also the capital of the Confederate States. Many Civil War battles were fought in efforts to capture the capital. After the burning and surrender of the city on April 3, 1865, Richmond was occupied by Federal forces until 1870.

POPULATION: The corporate population of Richmond was 27,570 in 1850. The city's decades of greatest growth were between 1900 and 1910—an increase from 85,050 to 127,628; and between 1910 and 1920—an increase from 127,628 to 171,667. In 1950 the population was 230,310; in 1960, 219,958.

Richmond, CHARLES LENNOX, fourth Duke of Richmond and Lennox, born in England, in 1764; died near Richmond, Canada, Aug. 20, 1819. He entered the army in his youth and rose through the grades until he became a general in 1814. From 1790 to 1806, he served in Parliament as representative for Sussex, succeeding to the dukedom on the death of his uncle in the latter year. The following year he was made a privy councillor and named Lord Lieutenant of Ireland, where he remained until 1813. After the Napoleonic wars, in which he served, he was appointed Governor-General of British North America (1818). He died of the bite of a hydrophobic fox.

Richmond, SIR WILLIAM BLAKE, painter, born Nov. 29, 1842, in London, England; died Feb. 11, 1921, in Hammersmith, England. An early admirer of Ruskin and the pre-Raphaelites, he studied at the Royal Acad. From 1865-69 he worked in Italy. He succeeded Ruskin as Slade Professor of Fine Arts at Oxford in 1878, remaining there until 1883. He became an associate of the Royal Acad. in 1888 and an Academician in 1895. Richmond was chiefly a painter of children, of subjects from mythology, and of portraits. He is noted for his portraits of some of the leading men of the day, including Darwin, Browning, Gladstone, and Bismarck, and for the mosaic decorations which he designed and executed in St. Paul's Cathedral, London.

Richter (rik'tēr), HANS, German musician, born in Raab, Hungary, Apr. 4, 1843; died Dec. 6, 1916. His father held an important position in the cathedral of Raab when Hans was born. He

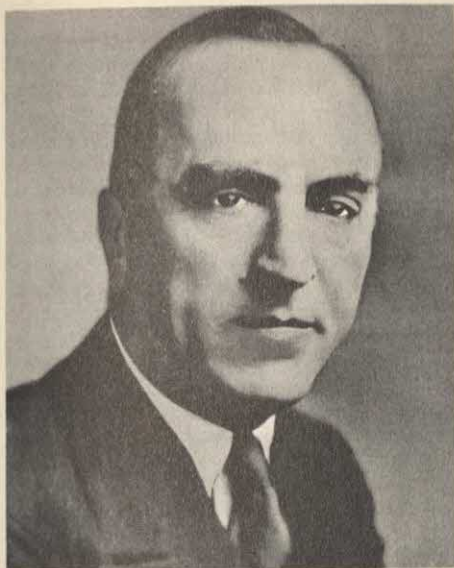
entered the Conservatorium in Vienna in 1859, where he played the horn in the orchestra of the Kärnthnerthor Opera. He was made conductor of the National Theater in Munich in 1868, of the National Theater at Pesth in 1871, and of the Court Opera Theater in Vienna in 1875, which position he held until 1898. In the last-mentioned year he became conductor of the Manchester Philharmonic Society. Richter played in many of the leading cities of Europe and may be considered one of the most eminent orchestra conductors of the early part of the 20th century. He was an authority on Wagner and Beethoven.

Richter, JEAN PAUL FRIEDRICH, usually called Jean Paul, author, born in Wunsiedel, near Bayreuth, Germany, Mar. 21, 1763; died Nov. 14, 1825. His father was a schoolteacher and organist, and died while the son was attending the gymnasium at Hof. He entered the Univ. of Leipzig in 1781 to study theology, but became deeply interested in literature and science. Poverty caused him to leave the university in 1784, and he returned to live with his widowed mother at Hof. He became tutor to the children of several wealthy families. In the meantime he wrote his first composition, "The Praise of Folly." His writings were not favorably received until 1793, when he published "The Invisible Lodge."

In 1801 Richter married Caroline Meyer, and the two spent some years in travel, visiting Goethe, Schiller, and Wieland. In his work, Richter displayed an acumen, a rare sense of humor, and a vivid imagination. Among his writings not named above are "Hesperus," "Marriage of Sieben Käs, the Advocate of the Poor," "Titan," "Wild Oats" ("Flegeljahre"), and "Life of Quintus Fixlein."

JEAN PAUL RICHTER





Courtesy Eastern Air Line

EDWARD RICKENBACKER

Rickenbacker (*rĭk'ən-bāk-ēr*) (name changed from German REICHENBACHER), EDWARD VERNON ("EDDIE"), aviator, born in Columbus, Ohio, Oct. 8, 1890. He won renown as an automobile racing driver and went to France in 1917, in World War I, where, at his own request, he was transferred to the Air Service. In this service he became the most successful American aviator in action, personally bringing down 26 enemy aircraft. He retired with the rank of captain and earned many honors, including the Congressional Medal of Honor. He organized the Rickenbacker Motor Co. and later became successful in the aviation industry; he was appointed (1942) president and general manager of Eastern Airlines (later chairman of the board). During World War II he undertook special missions for the U.S. government; in the course of one trip his plane crashed in the Pacific, and he and his companions were rescued after three weeks adrift on a raft. His story of this experience, "Seven Came Through" (1943), was as widely read as his account of his adventures in World War I, called "Fighting the Flying Circus" (1919).

Rickets (*rĭk'ĕts*), a common nutritional disturbance of early childhood. It is characterized by weakness of muscles, softening and deformity of the bones (particularly of rib cage and bones of legs), poor dental development, delay in growth, and, in extreme cases, dwarfism. Rickets is a complex metabolic disturbance resulting from Vitamin D (see *Vitamins*) deficiency and resultant interference with absorption of calcium and phosphorus and failure to deposit these substances in the developing bones. Exposure of the body to natural sunlight or to ultraviolet light

RIDING

and administration of Vitamin D in any of its forms will prevent rickets.

Riddle (*rĭ'dl*), a saying with an obscure meaning, intended to be guessed. Riddles may be in the form either of statements or questions. In folk stories or myths, riddles were often used to discover the "true" prince or princess or the true hero. A simple riddle is illustrated in the following question and answer: Why is an orange like a church steeple? Because they both give forth a peel (peal). The play on words is a common element in riddles.

Rideau (*rê-dō*), a river of Ontario, which rises in Lake Rideau and, after flowing ca. 45 m. toward the northeast, flows into the Ottawa River at Ottawa. It is a link in the Rideau Canal, which was completed in 1832. This waterway extends from the city of Ottawa to Kingston. The canal has 47 locks, is 123.5 m. long, and has a minimum depth of 5.5 ft. Originally built for strategic purposes, it is now the center of a resort and recreation area.

Ridgway (*rĭj'wā*), MATTHEW BUNKER, general, born at Ft. Monroe, Va., March 3, 1895. The son of an army officer, he was graduated from West Point in 1917 and served in World War I. He later taught at West Point and served in various commands and on the general staff. In April 1943, as commander of the 82nd Airborne Division in North Africa, he planned and directed the first large-scale U.S. airborne attack, that on Sicily. In August 1944 he was sent to the West European front. In 1945 he was shifted to the Pacific area. In 1950 he became the commander of the U.S. Eighth Army in Korea (*q.v.*). Ridgway succeeded Gen. Douglas MacArthur (*q.v.*) in the Far East and Korea in 1951, was appointed supreme commander of NATO (1952), and became chief of staff of the U.S. Army (1953). He retired in 1955 and published his memoirs, "Soldier" (1956).

Ridgway (*rĭj'wā*), ROBERT, ornithologist, born in Mt. Carmel, Ill., July 2, 1850; died in Olney, Ill., March 25, 1929. He attended school in Illinois. He was later appointed zoologist on the U.S. geological exploration of the 40th parallel in 1867-69, under Clarence King. In 1877 he published a report based on information gathered on the expedition. In 1880 he became curator of birds in the U.S. National Museum at Washington. He helped found the American Ornithologists' Union, of which he was president for many years. His most important work is "Birds of North and Middle America" (1901-19), in eight volumes. Other publications are "A History of North American Birds" (1874), "Water Birds of North America" (1884), and "Nomenclature of Colors for Naturalists" (1886).

Riding (*rĭd'ĭng*), the art of taming domestic animals, especially horses, to fit them to be ridden

for pleasure and for traveling. Horsemanship was first developed upon a high plane in the Orient and Persia, where the horse has been highly favored from remote antiquity. Arabian steeds have long been noted for their agility and endurance. The long stretches of pastoral lands made the horse specially valuable in traveling rapidly for long distances, while the camel served more particularly for extended travel in the desert. Horsemanship was a highly developed art among the Greeks, who employed the horse in festivals and for riding, and it was afterward introduced into Rome and the countries of Western Europe. Riding continued to be a favorite mode of traveling until modern times, when it was replaced largely by the use of mechanical devices. It is still a wholesome athletic pastime, in which the principal muscles of the body are called into active play. Usually limited to short pleasure trips in North America, riding remains an important factor in the sports and athletic exercises of Europe.

Horses have three natural paces, known as *walking*, *trotting*, and *galloping*; these may be accelerated and improved by training. The horse's head should be reined backward to a graceful position, the step should be shortened, and the animal should be trained to move with spirit. The rider should assume an upright position and be equipped with spurs and a short riding whip. The saddle should be well fitted to the horse and the stirrups should be adjusted to the needs of the rider. Considerable practice is needed to accustom the body to the natural position of riding, but it can be readily acquired through practice of the art daily or several times per week. See *Horse*; *Race*.

Ridley (*rid'li*), NICHOLAS, a leader of the Reformation, born at Unthank, Northumberland, England, about 1500; suffered martyrdom Oct. 16, 1555. After attending the grammar school of Newcastle-upon-Tyne he entered Cambridge Univ., where he was ordained priest in 1524. The spirit of the Reformation had already spread to various parts of England, but Ridley was more forcibly imbued with the new doctrines by spending three years in France, after which he returned to England and ardently taught the reformed faith. In 1530 he became undertreasurer of Cambridge Univ., and shortly after signed the decree of that institution against papal jurisdiction in England. He was appointed king's chaplain in 1540, elected master of Pembroke Coll., Cambridge, the same year, and in 1545 became a canon of Westminster. In 1552, he visited Princess Mary at Hunsdon, but, failing to persuade her to leave the Catholic faith, he concurred in the proposals to exclude her from the throne, giving his support to Lady Jane Grey instead. Soon after the death

of Edward VI, he delivered a sermon at St. Paul's Cross in opposition to Mary, declaring her illegitimate and predicting that her ascension would be detrimental to England. He was arrested shortly after in accordance with the proclamation issued by Mary and committed to the Tower. Cardinal Pole named a commission to try Ridley for heresy; he was found guilty and sentenced to death in 1554. Efforts were made to cause him to recant, but he remained steadfast and, with Latimer, was burned at the stake in Oxford.

Ridpath (*rid'pāth*), JOHN CLARK, educator and author, born in Putnam County, Ind., April 26, 1840; died in New York City, Sept. 30, 1900. He was graduated with honors from De Pauw Univ., became professor in Baker Univ., Kansas, in 1867, and in 1869 took the chair of English literature in De Pauw Univ. Later he became professor of history and political philosophy, and in 1879 was made vice president of the institution. He succeeded in raising the university endowment to \$2,000,000 and in 1885 resigned to devote his time to literature. His first book was "Academic History of the United States" (1875). He contributed to magazines, and was for a time editor of the *Arena*, of Boston. He edited "The Ridpath Library of Universal Literature," and also published "Life of James A. Garfield" and "History of the United States."

Riel (*rē-ēl'*), LOUIS, Canadian revolutionary, born at St. Boniface, Manitoba, Oct. 23, 1844; died Nov. 16, 1885. He was descended from French and Indian parentage, was educated for the priesthood in the Roman Catholic Seminary at Quebec, but did not take orders in the church. In 1869 he became the leader of the Red River Rebellion, which broke out after the Northwest Territory was purchased by the Canadian government from the Hudson's Bay Co. The settlers at that time numbered about 12,000 and they considered themselves ignored in the reorganization of civil affairs. The malcontents organized a provincial government and took possession of Ft. Gary, now Winnipeg, but Col. Wolseley was sent to the seat of trouble with a force of 1,440 men in 1870. Riel fled to the U.S., but returned to his native country soon after, where he was elected to the Dominion Parliament in 1873 and again in 1874 for the district of Provencher. He attempted to take his seat, but was expelled. In 1878 he formed a conspiracy with the Fenians to conquer the Northwest, and in 1884 became president of a provisional government that had been established at St. Laurent, near the Saskatchewan River. Gen. Middleton was sent to capture the headquarters at Batoche. Riel was soon captured and convicted of high treason at a trial in Regina, where he was condemned to death and hanged.

Riemann (*rē'män*), GEORG FRIEDRICH BERNHARD, mathematician, born in Breselenz near Dannenberg, Hanover, Sept. 17, 1826; died in Selasca, Lago Maggiore, July 20, 1866. He studied at the universities of Göttingen and Berlin, and was appointed professor of mathematics at Göttingen (1857). Noteworthy for developing the theory of functions, he was also devoted to mathematical physics and problems of geometry (so-called Riemann geometry). He was author of a work called "On the Hypotheses Which Form the Foundation of Geometry" (1867).

Rienzi (*rê-ñ'zê*), COLA DI, statesman, born in Rome, Italy, in 1313; died Oct. 8, 1354. He was descended from humble parents, but was endowed by nature with remarkable power of oratory, and secured the advantages of a liberal education, including instruction in rhetoric, history, philosophy, and poetry. His ambition to free Rome from its thralldom to the nobles was first excited when his younger brother was assassinated by a Roman nobleman, and he was even more aroused because punishment of the offender was impossible. In 1343 he joined Petrarch and visited the court of Pope Clement VI, at Avignon, where he described the tyranny of the nobles in a remarkable oration. It was through the effort of Petrarch that Rienzi was given a favorable hearing, and subsequently he received an appointment as notary to the chamber of Rome. For three years he advocated reform without avail, but in 1347 he took advantage of the governor's absence from the capital and successfully planned a revolution.

Rienzi, as a means to form a concerted movement, held an assembly of his friends on Mt. Aventine, where he proposed a plan of government that he called the *Good Estate*, and induced them to subscribe an oath in support of it. With 100 horsemen and the support of the Pope's legate he made his way to the capitol, where the title of tribune was conferred upon him by the people. The common people having attained an easy triumph, he banished a number of nobles from Rome, and amid great rejoicings the proclamation went forth that the Eternal City would again revive its former glory and power. At first successful, he was confirmed in authority by the Pope, but the powerful nobles still opposed him bitterly, while the necessary taxes for the support of the government excited opposition among the common classes.

In 1348 Rienzi was compelled to withdraw from Rome after a reign of seven months. He fled to Naples and afterward spent several years with the Franciscans in the Apennines. He ventured a second time to attempt the deliverance of Rome by applying, in 1350, to Charles IV, Emperor of Germany, for assistance, but that sovereign was unfavorably impressed with his



COLA DI RIENZI

schemes of revolution and delivered him to Pope Clement as a prisoner, who held him captive for three years. Innocent VI not only released him but decided to assist Rienzi in crushing the Roman nobles, hoping thereby to rid himself of a demagogue named Boroncelli. Rienzi immediately raised a large body of soldiers and made a triumphal entry into Rome, where much rejoicing was occasioned by his return. However, the barons opposed him by fortifying themselves in their castles, and he abandoned public concern for good living. His administration was attended by many disturbances and after a rule of two months he was attacked at the capitol by a crowd of people and was put to death under great indignities. Richard Wagner made him the hero of his opera of the same name.

Rietschel (*rêch'el*), ERNEST, sculptor, born at Pulsnitz, Germany, Dec. 15, 1804; died Feb. 21, 1861. He studied art at the Dresden Acad., where he was awarded several prizes for his drawings, and afterward was a pupil of Rauch in Berlin. He was made professor at the Dresden Acad. in 1832, which position he held until his death. He is the founder of the Dresden School of Plastic Art. He executed monuments of many prominent men, including the monument of Luther at Worms and the Goethe-Schiller monument in Weimar.

Rifle (*rî'l*), the name applied to a shoulder arm having some form of spiraling grooves in the bore to impart rotation to the projectile. It is also a common practice in the military service to refer to long-range artillery pieces as rifles.

The development of the modern rifle has been a gradual evolutionary process starting somewhere near the year 1300. Roger Bacon's knowledge of black powder, in the middle of the 13th century, brought about the conception of the first gun for making use of this powder as a propellant. The first guns were merely crude

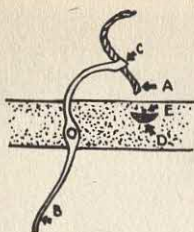
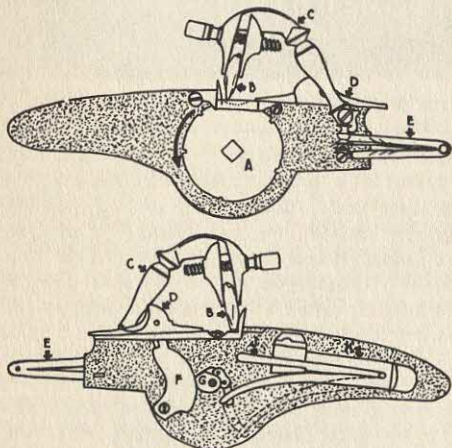


Diagram courtesy Natl. Rifle Assn. of America

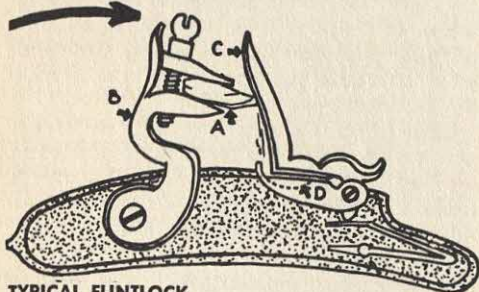
EARLY MATCHLOCK

A lighted wick ignited at *A* is carried in the clamp end *C* of the serpentine trigger *B*. Pulling the trigger lowers the flame into powder pan *D* and the main charge is ignited through small hole *E*



TYPICAL WHEELLOCK

The ignition is furnished by the rotation of serrated wheel *A* which rotates in the direction indicated and strikes sparks from a piece of flint *B* which is held firmly against the wheel by the clamp *C* and the spring *E*. When the lock is cocked, the cam *G* presses against the arm *F* and holds the cover *D* away from the pan containing the powder. Pulling the trigger releases the catch *J* which holds the wheel in the locked position and the spring *K* rotates the wheel when it returns to its normal position indicated in dotted lines



TYPICAL FLINTLOCK

When the trigger is pulled, the hammer *B* springs forward striking flint *A* against the anvil *C*. The anvil flies forward and the sparks drop down into powder pan *D*

cannons; the shoulder weapon was gradually evolved during the 14th and 15th centuries.

During the first two centuries of the shoulder weapon's development, it was not successful in replacing the bow, lance, and pike, as a primary weapon of war, because of its inaccuracy, short range, and inconvenience of loading. As a soldier was instructed during those years, it took as many as 30 separate motions to load a shoulder arm preparatory to firing. The shoulder arm was not recognized as a superior "war weapon" until about the middle of the 16th century, when armored knights found their armor no longer offering the protection in battle that it had in the past.

It is believed that the effects of rifling were first discovered about 1500. It was found at that time that spiraling grooves in the barrel of a rifle would improve the accuracy of the gun. The reasons for this phenomenon were not observed until the middle of the 18th century, when it was concluded that the accuracy was improved because the projectile was rotating in flight. Early lack of knowledge of this is indicated by the fact that some of the barrels had straight grooves, which of course did not rotate the projectile. Even though rifling was invented as far back as 1500, muskets having smooth bores were in use as late as the 19th century.

The first rifles were fired by a system referred to as a matchlock. In its earliest form, the matchlock consisted of an S-shaped metal piece, secured in an erect position, to one point on the stock. The top end was split to receive a slow match which usually consisted of a piece of smoldering tinder. The lower part of the S projected below the stock so that the shooter, by pulling back on it, could lower the lighted match into the powder train leading to the chamber. About the same time that rifling was discovered, the wheellock was invented in Germany. The wheellock consisted of a serrated wheel revolved by a spring. The lock was wound like a clock, and when released by the trigger, the wheel revolved rapidly, striking sparks from a piece of flint. The sparks fell into a priming pan and ignited the priming powder which flashed through the touch-hole.

It is generally conceded that the flintlock was invented early in the 17th century. The operation of the flintlock (*q.v.*) is well known, and the peak of its perfection was found in the famous "Kentucky rifle." There is no definite date at which any one of the various improvements replaced the older systems completely, as they were all used concurrently during overlapping periods. Although Forsythe adapted fulminate of mercury to firearms ignition in the early 19th century, its use in metallic cartridges did not occur until about 1850. The flintlock, on both

smooth-bore and rifled shoulder arms, was used as late as the American Civil War.

The first rifle projectiles used were round balls. Capt. Minié of the French army is credited with using one of the first perfected types of elongated projectiles. His projectiles had a hollow base which was expanded to the bore diameter of the rifle by the gas pressure generated by the burning powder.

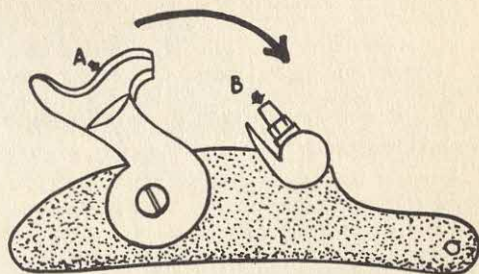
Most of the early rifles were loaded from the muzzle. Powder was first poured into the muzzle and then the bullet was rammed home on top of it. Some sporting rifles made use of breech-loading systems previously, but breech-loading rifles did not come into general use until about 1850. These rifles were designed for ammunition which was assembled with powder and bullets in a metal or paper case.

The development of sporting rifles closely parallels the development of the military rifle, although the sporting designs were much more elaborate than the military models. Target shooting became popular during the 19th century. Organizations such as the National Rifle Assn. of England, which had its first meeting in 1860, and the National Rifle Assn. of America, which came into being in 1871, have done much to promote the sport of target shooting. The National Rifle Assn. sponsored the first national rifle matches held in the U.S. in the year 1873 at Creedmoor, N.Y. Both the U.S. and English organizations are very active today.

By the end of the Civil War the breech-loading weapon had been accepted for general use. The first breech-loading rifle developed by the U.S. for military use in 1866 was .50 caliber. In 1873 a change was made to .45 caliber. During the next few years the trend was toward smaller-caliber rifles in most countries. In the U.S. the .30 caliber came into being in the form of the Model 1892. This rifle was basically the Norwegian Krag-Jorgensen type, which was modified by U.S. Army ordnance officers in making improvements. Many changes were made in this rifle between 1892-99. The Krag rifle was one of the weapons issued to U.S. forces during the Spanish-American War. The final rifle of this type was the Model 1898 Krag which was later used as a training rifle during World War I and was the standard arm issued to National Guard units for several years. It uses a rimmed cartridge known as the 30/40 Krag.

In 1888 England adopted the .303 rifle and the Germans produced the 8-mm. Mauser rifle. The Mauser factory in Oberndorf produced rifles of various calibers for other countries, including the 7-mm. rifle for Spain and the 7.65-mm. rifles for some of the South American countries. The Mauser rifle of that time was the bolt-action type as we know it today. In 1903 the U.S. adopted

a rifle with a bolt action of the Mauser type. This rifle, known as the M1903 Springfield,



TYPICAL PERCUSSIONLOCK

When the trigger is pulled, the hammer *A* springs forward and strikes the anvil *B* with sufficient force to set off a percussion cap containing the primer charge

together with the M1917 Enfield rifle which was chambered for the U.S. .30 caliber cartridge, was used by this country during World War I. The cartridge for these rifles is commonly referred to as the .30-'06. The cartridge is rimless and is not interchangeable with the 30/40 Krag. The M1903 has been modified since its first adoption. These modifications are identified by M1903A1, M1903A3, and M1903A4. Enfield and Springfield rifles were used by all branches of the military services during World War II. They were standard issue in the Navy and Coast Guard. The Army and Marine Corps used them to a great extent because of a shortage of M1 automatic rifles during the first part of the war. The M1903A4, which is basically the same as the M1903 with a scope sight attached, was standard issue in all U.S. military services as a sniper's rifle during World War II.

In 1936 these rifles were superseded by the U.S. rifle, caliber .30, M1, commonly known as the Garand rifle. This rifle is a semi-automatic, gas operated, clip-fed, shoulder weapon and is now standard equipment for the U.S. Army, U.S. Navy, and U.S. Marine Corps. The U.S. Navy did not standardize on the Garand rifle until shortly after World War II, although the U.S. Marines used the Garand during this war. The M1903 Springfield has gained fame as a military weapon and is one of the most accurate rifles yet produced. It has also gained fame as a target rifle on the ranges at Camp Perry, O., where the national rifle matches have been held since 1907.

Small-bore target shooting, with a .22 caliber target rifle, has become a recognized sport in many countries. The ammunition used is the .22 caliber long rifle rim-fire cartridge. Several rifles, incorporating bolt actions or single-shot falling-block actions, of target-rifle quality, are produced

in the U.S. by commercial plants. In 1922 a .22 caliber rifle was produced at Springfield armory for use in training, simulating the training with the M1903 .30 caliber rifle. The latest model of this rifle is the U.S. rifle, caliber .22, M2, which is capable of accuracy comparable with the best commercial models. The national small-bore rifle matches were held at Camp Perry, O., each year from 1920 to 1941; they were resumed in 1946, but have since been held in different localities. In addition to many individual and club team matches, every year teams of 20 shooters each from the U.S., Australia, Canada, India, and South Africa compete for a trophy presented by Sir Thomas R. Dewar of London in 1909. The U.S. team fires its score at the national rifle matches.

A great variety of modern sporting rifles are manufactured in the U.S. These range in caliber from the .22 rim-fire to the .375 H & H Magnum. For small-game shooting, the trend is toward rifles of small caliber and high velocity. One example of this type is the .22 caliber Swift which has a muzzle velocity of about 4,150 ft. per second with a 48-grain bullet. After several years, rifles chambered for the government .30 caliber cartridge, commonly referred to as the .30-'06, are still popular for medium and large game. The military full-metal case spitzer bullets are not used on game. Sporting loads incorporating hollow point, soft point, or some special form of expanding bullet are produced by the commercial loading companies for hunting purposes.

Several individual gunsmiths in this country have developed what are termed "wildcat" cartridges and are chambering rifles adapted to their use. The cartridges are usually made up from commercial cartridge cases which have been altered by special loading tools manufactured for this purpose.

Riga (*rē'gá*), a seaport of Europe, capital of the republic of Latvia, on the Duna (Dvina) River, 6 m. from the Gulf of Riga. It is connected with other trade centers by railroads, and is the seat of an ancient cathedral. It has numerous monuments and parks, and is the seat of the Latvian Univ., which has a large faculty and about 7,000 students. The noteworthy buildings include the commercial exchange, the Church of St. Peter, the former castle of the old Knights of the Sword, the public library, the seminary for priests, and the central railroad stations. Among the manufactures are cotton and woolen goods, leather, soap, starch, machinery, oilcloth, and tobacco products. It has a large trade in lumber, cereals, and livestock. Riga was founded in 1201 by Albert, bishop of Livonia, and was long an important member of the Hanseatic League. It was annexed to Poland in 1561, but

became a Swedish possession in 1621 under Gustavus Adolphus. In 1710 it became a part of Russia. The Germans bombarded it successfully and finally captured it in 1917, withdrawing in 1919. In World War II, it was again a battlefield. Population, *ca.* 400,000.

Riga, GULF OF, an inlet from the Baltic Sea, in the western part of Russia. It is about 105 m. long and 60 m. wide. At its entrance is the island of Oesel. It receives the water of the Dvina River.

Rigaud (*rē-gō'*), HYACINTHE, painter, born in 1659 at Perpignan, France; died at Paris in 1743. When 21, he went to Paris where he studied at the Academy and was especially interested in the style of Van Dyck's portrait paintings. In 1700 he became a member of the Academy. Although he also did some historical paintings, Rigaud's art speaks best in his portraits, showing in their warm colors and brilliant composition the pomp and splendor of the court of Louis XIV, whose portrait, together with that of Bossuet, must be called Rigaud's master works.

Riggs (*rigz*), KATE DOUGLAS WIGGIN, author, born in Philadelphia, Pa., Sept. 28, 1856; died in Harrow, England, Aug. 24, 1923. A student of kindergarten methods, she organized the first free kindergarten on the Pacific Coast, in 1878. In 1881 she married Samuel B. Wiggin and, in 1883, produced the first of her children's books, "The Story of Patsy." After the death of her husband in 1889, she married (1895) George C. Riggs, but continued to write under the name of Wiggin. "Rebecca of Sunnybrook Farm" (1903) was her greatest success, followed closely by "Mother Carey's Chickens" (1911).

Right of Way (*rīt of wā*), the privilege to pass over land belonging to another, either permanently or for a brief time, according to the nature of the easement. A right of way is said to be *private* when it is enjoined by a certain person or class of persons, while one that is open for general use is termed a *public* right of way. A highway is a public right of way, while a road reserved for special use is a private right of way. Tracts of land occupied by electric and railway lines may be classed with private rights of way, since the ownership is vested in a particular person or company, although they are used for conveying general goods and persons. A right of way may be established by an act of legislation, or by the owner dedicating a tract of land to the public.

Rights of Man (*rits of mǎn*), a manifesto issued (1789) during the French Revolution by the constituent assembly as a preamble to the proposed Constitution. It stated the basic principles which inspired the Revolution and was drafted by the Marquis de Lafayette, who had been inspired and guided by the American Dec-



Courtesy Wide World Studio, N. Y.

RIGOLETTO, ACT I

laration of Independence. The final draft was passed by the assembly and accepted by the king on Oct. 5, 1789; it is much broader in its scope than its American model.

Rigi (*rĕ'gĕ*), or **RIGHI**, a mountain of Switzerland, located between Lakes Zug and Lucerne, in the canton of Schwyz. It is 5,910 ft. high and is one of the most scenic and beautiful peaks of Switzerland. The summit is reached by two rack-and-pinion railways.

Rigoletto (*rĭg-ô-lĕt'ô*), one of the most famous operas by the great Italian composer Giuseppe Verdi (*q.v.*), containing many popular arias. It was first performed in Venice, Italy, in 1851, coming four years later to the American stage. In the role of the Duke in this opera the great singer Enrico Caruso (*q.v.*) made his debut at the Metropolitan Opera House in New York (1903).

Rigor (*rĭg'ĕr*), in medicine, a sudden chill, generally occurring in combination with a high fever.

Riis (*rĕs*), **JACOB AUGUST**, journalist and author, born at Ribe, Denmark, May 3, 1849; died May 26, 1914. He studied in his native country, but came to America at the age of 20. After working in New York City as a carpenter and cabinetmaker, he became a police reporter for the *New York Sun*. While working in that capacity he took an active interest in promoting tenement house and school reform, and aided the movement which resulted in establishing small parks in many parts of the city. His books include "How the Other Half Lives," "The Making of an American," "The Battle with the Slums," and "Theodore Roosevelt, the Citizen."

Riley (*rĭ'li*), **JAMES WHITCOMB**, poet, born in

Greenfield, Ind., Oct. 7, 1853; died July 22, 1916. His father was a successful business man of Greenfield and intended to have the son study for a profession, but he tired of his studies and became a sign painter. Later he joined a theatrical company, with which he traveled for some time, and in the meantime wrote comic songs and revised plays. He began contributing prose and verse to periodicals in 1875, and soon after joined the *Indianapolis Journal* as a regular writer. After several years he located in Greenfield, where he devoted his entire time to literary work, both as a poet and as a public reader. The writings of Riley are numerous, including many in the "hoosier" dialect, while others are sentimental,



JAMES WHITCOMB RILEY

Medal by Lorado Taft (1860-1936)

tender, and prosaic. Few 19th century writers were able to touch the popular taste so successfully, a fact evidenced by the large sale of his books and the great demand made upon him as a public reader. His works include "Afterwhiles," "Old Swimmin' Hole," "Green Fields and Running Brooks," "Pipes o' Pan at Zekesbury," "Poems at Home," "Character Sketches and Poems," "Rhymes of Childhood," "Out to Old Aunt Mary's," and "Neighborly Poems."

Rilke (*rîl'kē*), RAINER MARIA, poet, born Dec. 4, 1875, in Prague, Bohemia; died Dec. 29, 1926, in Switzerland. Rilke's youth was on the whole unstable and unhappy. He was first sent to a military school, in which he later said he suffered anguish, and then to a business school, where he was almost equally unhappy. Finally, after spending some time at the Univ. of Prague, he abandoned school altogether and traveled about Europe, visiting Italy, Russia, the Scandinavian countries and others. In 1905 he spent a year in France as secretary to the sculptor Auguste Rodin, leaving when the two found they were emotionally unsuited to each other. He had already published his first book of poems, "Leben und Lieder: Bilder und Tagebuchblätter" in 1894. Now he entered on a particularly fruitful period. In 1906, he published "The Tale of the Love and Death of Cornet Christopher Rilke" and in the following two years two volumes of poems appeared. He then traveled around the African shore of the Mediterranean and then lived for a year in Duino castle near Trieste, where he wrote his "Life of the Virgin Mary" and began the volume of poems which later were published as the "Duino Elegies." His "The Journal of My Other Self" ("Die Aufzeichnungen des Malte Laurids Brigge") was written after and about his Mediterranean journey and published in 1910. He lived during the last four years of his life in Valais, Switzerland, where he completed these elegies and wrote the 55 poems which compose "Sonnets to Orpheus." In addition to his own writings, Rilke translated works by Paul Valéry, André Gide, Elizabeth Barrett Browning, Petrarch, and Stéphane Mallarmé.

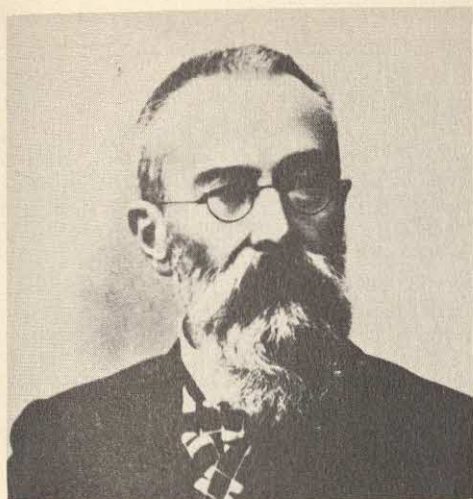
Rilke was perhaps Germany's most important lyric poet at the turn of the century. His prose was also of the same high level. His delicacy of style, his mysticism, and his rich, imaginative imagery later had great influence on the younger British and American poets of the third and fourth decades of the 20th century. Almost all of his works have been translated into English; in addition, many of his letters were collected and published in 1945, the volume "31 Poems" appearing in 1946.

Rimbaud (*rîm-bô'*), JEAN ARTHUR, poet, born Oct. 20, 1854, in Charleville, France; died Nov.

10, 1891, in Marseilles, France. He began to write poetry when he was only 10 and when he was 17 wrote "Le Bateau Ivre," which he sent to the poet Paul Verlaine in Paris. Verlaine, not realizing that the author of the verses was so young, urged Rimbaud to come to Paris. The youthful poet spent the next two years partly in Paris, partly in traveling about with Verlaine. Their relations came to an abrupt ending in Brussels, when Verlaine attempted to kill Rimbaud and actually succeeded in wounding him. Rimbaud's "A Season in Hell" (1873), the only work he ever published himself, tells in allegory of his relations with the older poet. At this juncture, Rimbaud determined to give up writing. He traveled about Europe for a time, then went to the Netherlands Indies and finally settled in Abyssinia, where over a period of years he attained considerable commercial success. His European acquaintances believed him dead and in 1886 Verlaine published, as he believed posthumously, all of Rimbaud's poems in a volume entitled "Les Illuminations." In 1891, Rimbaud was forced to return to France for an operation on a tumor of the knee, but he developed gangrene and died before reaching his destination. Although he wrote no poetry except in the years before he was 20, Rimbaud had enormous influence on 20th-century writers, including James Joyce and Gertrude Stein.

Rimini (*rî'mê-nê*), a city of Italy, on the Adriatic Sea, 70 m. S.E. of Bologna, with which it is connected by a railroad. It is located on a fertile plain, on the banks of the Marecchia River, and contains a large number of monuments and historic buildings, including a cathedral adorned with sarcophagi. Among the manufactures are wine, glass, sailcloth, clothing, and pottery. It has a considerable trade in agriculture products and merchandise. The city has several hospitals, a number of schools, and a public library of 30,000 volumes. About 10 m. N.W. of the city is a monumental pillar to mark the spot where Caesar stood at the time he addressed his army shortly before he crossed the Rubicon. It was attacked successively by barbarians, but for some time was important as an independent republic, its independence ending when Charlemagne annexed it to the papal territory. The independence of Italy and the construction of its railroad gave it a new era of prosperity. Population, ca. 45,000.

Rimsky - Korsakov (*rîm'skê-kôr'sâ-kôf*), NIKOLAI ANDREYEVITCH, composer, born at Tichvin, Russia, Mar. 18, 1844; died June 20, 1908. He studied music while training at the Imperial Naval Acad. and was encouraged in his musical pursuits by Balakirev (1811-89), noted Russian conductor, and composer and leader of the famed "Five," of which Rimsky-Korsakov later became a member.



NIKOLAI RIMSKY-KORSAKOV

In 1865, while still a midshipman in the Russian navy, Rimsky-Korsakov composed his first symphony (in E minor). In 1867 he produced the symphonic poem "Sadko," which he later turned into an opera. In 1871 he was appointed professor of composition and instrumentation at the St. Petersburg Conservatory, where his pupils included Glazunov and Stravinsky (*qq.v.*). He retired from the navy in 1873. From 1886 to 1890 he conducted the Russian Symphony Concerts. His most important compositions are his operas, which include "The Maid of Pskov" (also called "Ivan the Terrible," 1873; revised, 1892), "The Snow Maiden" (1882), and "*Le Coq d'Or*" (completed in 1907, but not performed until after his death). Among his best-known orchestral works are the "Antar" symphony (1868) and the symphonic suites "*Capriccio Espagnol*" (1887) and "Scheherazade" (1888). The last-named composition was used by Diaghilev as ballet music. Rimsky-Korsakov also wrote a book on orchestration and an autobiography, "My Musical Life."

Perhaps even more than for his own compositions, Rimsky-Korsakov was for some time noted for his teaching and for his rewriting and orchestrating of such Russian works as Musorgski's "Boris Godunov" and Borodin's "Prince Igor" (in which he was assisted by Glazunov).

Rinderpest (*rīn'dēr-pĕst*) or CATTLE PLAGUE, one of the most dangerous of animal diseases, it affects ruminants, chiefly cattle, but sometimes sheep and goats. The infective agent is a filtrable virus which may be conveyed by contaminated fodder, litter, feed, etc., or by human or animal contact. Symptoms, including a high temperature, diarrhea, and marked inflammation of the mucous membranes, usually appear from three to nine days after exposure. Death occurs in a high percentage of affected animals, particularly in countries where the infection is newly introduced. The disease is highly infectious, and rigid quar-

antines are necessary to restrict the spread of the infection. In earlier years Russia and other countries in Europe have experienced severe epizootics of this disease. The disease has caused heavy losses in Asia, Africa, India, and several other tropical countries for many years.

Along with quarantine, considerable success has been attained in reducing losses from the diseases through vaccination. As the result of research investigations during World War II, the virus of rinderpest was adapted to the chicken embryonated egg, and an effective vaccine was produced by American and Canadian scientists. More recently, by passing the virus through rabbits and chicken embryos, alternately or in varying series, a more effective vaccine has been developed by American and Japanese scientists.

Rinehart (*rīn'härt*), MARY ROBERTS, novelist and playwright, born in Pittsburgh, Pa., in 1876; died in New York, N.Y., on Sept. 22, 1958. She was a graduate nurse, beginning her literary career with stories and articles for magazines. A World War I correspondent, she became noted as a writer of popularly acclaimed detective novels. In addition, she wrote many light, humorous stories around a character name *Letitia Carberry*, or *Tish*; these were later collected into books. Her novels include "The Circular Staircase" (1908), "Tish" (1916), "A Light in the Window" (1948), "The Best of Tish" (1955), and "The Mary Roberts Rinehart Crime Book" (1957). Among her plays are "Double Life" (1908), "Tish" (1919), and "The Breaking Point" (1923).

Rinehart, WILLIAM HENRY, sculptor, born near Union Bridge, Md., Sept. 13, 1825; died in Rome, Italy, Oct. 28, 1874. At 21 he apprenticed himself to a Baltimore marbleworker, and ten years later went to Italy, where he remained for two years. Returning to the U.S., he was employed by the government to execute several busts and a fountain figure for the Washington general post office. In 1858 he settled permanently in Rome. His masterpiece is "Clytie," on display in the Peabody Inst., Baltimore. Other works include "Love Reconciled with Death" (also in Baltimore), "Latona and her Children," and "Rebecca" (both at the Metropolitan Museum, New York City). Rinehart also completed the bronze doors, begun by Thomas Crawford (*q.v.*), of the Capitol building in Washington, D.C.

Ring (*rīng*), an ornament worn on the finger usually made of some metal, chiefly gold or silver. Rings are frequently set with precious stones. The *signet ring* was worn in ancient times to indicate authority. Later rings came into use as articles of ornament among the civilized nations, especially among the Jews and Persians, who used betrothal and wedding rings. Rings as tokens of marriage came into almost universal use in Christendom, and many were engraved with mottoes to



NIGHT VIEW OF RIO DE JANEIRO

indicate some sentiment, either of friendship or affection. The practice of wearing earrings is more recent, but rings seem to have been worn as adornments of the arms at a very early date. Primitive people also employ rings as adornments to decorate the nose, ears, and toes. Some look upon a ring as a charm against evil (see also *Amulet*). The pope uses what is known as the "fisherman's ring" which is engraved with the picture of St. Peter in a boat. With this ring the briefs are sealed. It is broken at the death of each pope.

Ring Current (*rīng kūr'ent*), an ion stream supposed to encircle the earth during magnetic storms. See *Magnetic Storm*.

Ring of the Nibelung (*rīng, nē'bē-lōng*), collective title of Richard Wagner's opera cycle, based on the epic of the "*Nibelungenlied*" (q.v.), and including "*Das Rheingold*" (1853-54), "*Die Walküre*" (1854-56), "*Siegfried*" (1856-71), and "*Götterdämmerung*" (1869-74). Performance of the "Ring" at Bayreuth (q.v.) in 1876 marked the peak of Wagner's career.

Ring-tailed Monkey (*rīng-tāld mūng'kī*). See *Capuchin*.

Ringworm (*rīng'wūrm*), a skin disease that appears in the form of circular patches. It is caused by a microscopic fungus parasite. The parasite preys upon the epithelial coverings of the skin, chiefly on the scalp, but also on the body. In men it frequently affects the skin in the vicinity of the beard. It is both chronic and contagious. See also *First Aid*.

Rio de Janeiro (*rē'ô dā zhā-nā-rô*), the capital and metropolis of Brazil, on the south-eastern coast, 75 m. s.w. of Cape Frio. It stands on the western shore of the Bay of Rio de Janeiro,

in which it has a magnificent harbor, one of the most beautiful and most secure in the world. The section along the bay is level, but it stretches westward over the slopes of low hills, and presents an appearance of remarkable beauty when viewed from the sea. The city has long been noted for its beautiful gardens and parks, waterworks, and churches. Among the most noteworthy buildings are the capitol, the national museum, and the cathedral. It has numerous asylums, hospitals, and educational institutions. The Univ. of Brazil, formerly the Univ. of Rio de Janeiro, was founded in 1920. It has several military, naval, art, and normal schools. The national library has 1,000,000 volumes. Another noteworthy feature of the city is its excellent water supply, with which are connected numerous fountains in the streets and public squares. Many of the public places are ornamented with statues and monuments.

The Bay of Rio de Janeiro was discovered in 1555 by the French, who formed a small settlement on the present site of the city, but it was captured by the Portuguese in 1567. Rio de Janeiro has always ranked as the most important trade center of Brazil. It is not only the chief military arsenal and political center of the republic, but it has fully one-half of the export and import trade of the country. The export trade consists largely of coffee, lumber, and minerals. The imports include mostly manufactured articles, though local enterprises are rapidly stimulating home production. Among the manufactures are furniture, tobacco products, cotton and woolen goods, metalware, glass, paper, pottery, and leather. Several railways furnish communication with the interior and railroad facilities are maintained at Niteroy, on the opposite side of the bay, with which Rio de Janeiro is connected by ferry lines. The country surrounding the city is agricultural. The 19-nation Inter-American Conference (1947) was held at Petropolis, a resort near the city, and the mutual defense pact adopted there is known as the Treaty of Rio de Janeiro. Population, ca. 1,750,000.

Rio de Oro (*rē'ô dā ô'rô*), also called WEST SAHARA, a Spanish possession and protectorate on the northwest coast of Africa. Its area is about 109,000 sq. m. with a population (ca. 50,000) consisting largely of natives, mostly nomadic Arabs, and some Europeans. The chief occupation is fishing. Agriculture is limited since the interior is desertland. Its capital is Villa Cisneros, and its government is headed by the governor of the Canary Islands (q.v.).

Rio Grande (*rē'ô grān'dā*), a river of North America, which has its source in the San Juan Mts. of Colorado and, after a general course of 1,800 m. toward the southeast, enters the Gulf of

Mexico a short distance below Brownsville, Tex. It is navigable only about 500 m. from its mouth. The channel is almost due north and south in New Mexico, where it receives the Puerco River, and thence forms the boundary between Texas and Mexico. The most important tributary is the Rio Pecos, in Texas. In Mexico it receives the Rio Conchos, the Rio Salinas, and the Rio San Juan. Brownsville, Del Rio, and El Paso, Tex., and Matamoras, Mexico, are the chief towns on its banks. The Rio Grande valley produces large quantities of citrus fruits and farm products.

Rio Grande do Norte (*dô nôrtê*), mountainous maritime state of northeastern Brazil, 22,189 sq. m. in area. The chief river is the Piranhas, and the capital is Natal. The climate is dry and hot; cotton, sugar cane, and rubber are produced here, as well as some tobacco. Other occupations include fishing and salt production. Population, ca. 750,000.

Rio Grande do Sul (*dô sôol*), southernmost state of Brazil, with an area of 91,310 sq. m. Its chief rivers are the Jacuhy and the Ibicuy (a tributary of the Uruguay). Its capital is Porto Alegre; chief occupation, cattle-raising and the exporting of dried meat. A healthful, moderate climate and good soil favor the production of wheat, tobacco, and vines. Copper, gold, coal, and precious stones are mined in this region. Manufactures include textiles and soap. Population, ca. 3,000,000.

Rio Negro (*nã grô*), a large river of South America, one of the chief tributaries of the Amazon. The source is in the plains of southeastern Colombia; it flows east to the boundary of Venezuela, makes a curve toward the south, and, after receiving the Dos Upes River, flows southeast and joins the Amazon at Manaus, Brazil. The entire course is 1,250 m., much of which is navigable. Large forests are contiguous to the Rio Negro. Direct communication is maintained between the Rio Negro and the Orinoco by the Cassiquari, thus joining the Orinoco and Amazon River systems into a great commercial route.

Rio Negro is likewise the name of a large river of Argentina, south of which is the region known as Patagonia. The source is in the Andes Mts. of Chile. In its course, which is 700 m., are many rapids and waterfalls. It flows into the Atlantic Ocean at about 41° south latitude.

Riot (*ri'it*), a tumult or disturbance of the peace by three or more persons, who assemble of their own authority to resist public officials or destroy public or private property. The assembly may be premeditated or spontaneous, and it may have for its purpose to terrorize the public, or to carry out some process of a public character in an unlawful manner. Whether the object sought by the group is lawful or unlawful is immaterial;

the essence of the offense lies in the methods which are employed. If three or more persons enter upon the execution of what ordinarily constitutes a riot, but fall short in carrying out their purpose, their offense is termed a *riot*. A riot which is designed to overthrow a government is treason. Such a demonstration, however, is not usually considered a riot. Among the famous riots of history are the Gordon riot (England, 1790), Bristol riot (England, 1831), Alton riot (U.S., 1837), Boston slave riot (U.S., 1854), Draft riot (U.S., 1863), Virginia City riot (U.S., 1865), and Anti-Chinese riot (U.S., 1886). Rioting is prohibited by statutory law and the punishments prescribed include a fine or imprisonment or both.

Riparian Rights (*ri-pā'ri-an rīts*), name for the rights and privileges of those whose lands border upon or are bounded by streams or rivers. Navigable bays, arms of the sea, and rivers are in most cases considered public highways, but the owners usually have the right of access, wharfage, and ferriage. In some countries the owner of land lying upon an unnavigable stream owns the bed of such stream to its center, while in others he has only the right to use the water under certain circumstances. For instance, he is not permitted to waste or pollute the stream, to divert the channel, or even to use all the water to the exclusion of other owners farther down the course. Even where a private stream runs through a premises, a part of the course being exclusively upon the property of a single owner, it cannot be polluted or used in a manner that would cause an injury to others.

Ripley (*rip'li*), GEORGE, author and journalist, born in Greenfield, Mass., Oct. 3, 1802; died in New York City, July 4, 1880. He was graduated from Harvard Univ. in 1823. After studying theology in the Cambridge Divinity School, he became pastor of a Unitarian church in Boston, in 1826. In 1840 he resigned his charge, lived for some years in Europe, and founded the *Transcendental Magazine*. Subsequently he originated the communistic Brook Farm, which he abandoned in 1847, at that time moving to New York as a staff editor of the *Tribune*. He contributed to a number of magazines, and published the "American Cyclopaedia."

Rip Van Winkle (*rip vān wīng'k'l*), a legendary character immortalized in one of the tales in Washington Irving's "Sketch Book" (1820). The story has been accepted as one of the classics of American literature and has also been dramatized. Of the plays, only that by Dion Boucicault is remembered. First produced in London in 1865, with Joseph Jefferson as *Rip*, it has been long remembered as one of Jefferson's greatest roles. This legend recalls many others in which a sleeper awakes after years to find



RIP VAN WINKLE

everything changed. (The seven sleepers of Mt. Celion slept 250 years; Epiminedes the Gnostic was unconscious for 57; Nourjahad—wife of that Mogul emperor who discovered attar of roses—is accredited with a short nap of only seven years.)

Irving's legend is warmly human, despite its eerie theme. At the foot of the Catskill Mts., in a tiny village, on the bank of the Hudson, lived Rip Van Winkle. Good-natured and kindly, loved by children, by his cronies, and by his faithful dog, but forever henpecked by his wife, Rip hated any kind of work. He preferred tramps through the forests, hunting and fishing, and "relaxing" at the local inn. Weary one day, high up in the hills, Rip was turning homeward when he heard his name called. The caller was a queer old man, making signs to Rip that he needed help with the cask he was carrying. Rip helped the old man until they came to an opening in the hills where an odd-looking crew of bearded men, in costumes like those in old Dutch paintings, were solemnly playing at ninepins; the rolling balls and falling pins echoed like thunder in the mountains. After he had lost some of his fear, he helped the keg-bearer distribute flagons of liquid from the keg, and presently was sipping the sparkling beverage himself. Before long his head sank lower, and he was asleep, soundly, dreamlessly asleep.

Rip awoke to find his dog gone and the gun by his side almost eaten away with rust. There was no trace of his strange companions. A waterfall tumbled down the path he had climbed with the old man to reach the opening in the hills above. Puzzled, he made his way back to the village. To his amazement, he found no one he knew, no one who knew him. He hardly knew himself, with the long, flowing beard he seemed to have grown. Before the inn a picture of someone named George Washington had replaced the

RITUAL

familiar picture of George III; Rip's own house was in ruins; and he heard strange talk of a war that had been won—a "revolution." At last he recognized a neat young woman with a baby as his grown-up daughter, and the villagers became satisfied that the "tramp" in their midst was really the neighbor who had disappeared so strangely 20 years before. He spent the remainder of his days in peace, playing with his grandchildren, and telling over the story of his adventure. The village legend was that every 20 years old Henry Hudson kept a rendezvous in the Catskills with his crew from the *Half Moon*, and that Rip Van Winkle had stumbled upon one of those ghostly gatherings and had been put to sleep by imbibing their ghostly brew.

Ristori (*rê-s-tô-rê*), ADELAIDE, OF MARQUISE DEL GRILLO, tragic actress, born in Cividale, Italy, Jan. 26, 1821; died Oct. 9, 1906. She was the daughter of strolling players and thus became connected with the stage in early childhood. She appeared in a number of leading Italian and French cities. She made a tour of Canada, the U.S., Mexico and South America. Her roles meeting with greatest favor include *Lady Macbeth*, and *Mary Stuart*.

Rittenhouse (*rit'-en-haus*), DAVID, astronomer, born near Germantown, Pa., in 1732; died in 1796. A descendant of the famous Mennonite, William Rittenhouse, he is believed to have built the first American-made telescope (1769) for observing Venus. He was also one of the first to use a spider's web in a telescope eyepiece (1786). He served during the Revolution as a member of the Pennsylvania assembly, and was state treasurer (1777-89). He succeeded Benjamin Franklin as president of the American Philosophical Society (1791-96).

Ritter (*rit'-tēr*), CARL, geographer, born in Quedlinburg, Germany, Aug. 7, 1779; died Sept. 28, 1859. After studying at Halle, he was made professor of geography at the Univ. of Berlin in 1820, and subsequently became connected with the military school as director. The work of Ritter, both as a teacher and author, has had a marked influence upon the study of geographical science, since he originated methods that were not known before his time. He deserves particular mention because of systematically accounting for the formation of rivers, glaciers, mountains, and other natural phenomena, associating with each geographical phenomenon such historical, geological, and physiological facts as render the whole interesting and more or less concrete. His writings on geographical subjects were numerous.

Ritual (*rit'-u-al*), a book which contains prayers and ceremonials of any kind, such as are used in churches, civic societies, or similar formal organizations. The term *ritualism* is gen-

erally applied to the extensive development of church ceremonials in the Church of England, especially as it came to be associated with the service of the Holy Communion by the High Church party about 1863. The purpose was to make the services more ornate and to employ a larger measure of the symbolic. In a general sense, ritualism may be said to embrace a system of conducting public worship according to prescribed forms, as distinguished from a system in which the form of worship is left chiefly to the discretion of the person in charge. Rituals are used largely in the Anglican, Roman, Greek, and several other churches.

Ritual Murder (rit'û-al mûr'dêr), the general term for human sacrifice connected with religious ceremonies. The early Christians were successfully defended against the charge of ritual murder in regard to the ceremony of the Eucharist, but the chief sufferers from such charges have been the Jews. In 1144, in the case of William of Norwich, the Jews were charged with murdering a Christian child in mockery of the Passion. It was said during the course of the next centuries that Christian blood was used in making the unleavened Passover bread, and that congregations in every country cast lots for the privilege of supplying that ingredient. Non-Jewish pens have been foremost in proving that the charge of ritual murder leveled against the Jews was unfounded, but it has survived into modern times.

Riukiu (ryû'kyû). See *Ryukyu*.

Rivals (ri'valz), THE, a famous comedy of manners by the English playwright Richard Brinsley Sheridan (q.v.), produced in 1775.

River (riv'êr), a stream of considerable size, usually formed of several brooks or creeks. It may flow into another river, a marsh, or some large body of water, as a lake, a gulf, or an ocean. Rivers are caused by drops of water falling upon the land, some of which sink into the surface and form springs and rivulets, while portions run down the slopes of the land and give rise to rills. The rivulets and rills usually combine with others and form creeks, which finally merge into a river. The land bordering on the sides of a river constitutes its *banks*. The *right bank* is on the right hand, as a stream descends, and the *left bank* is on the opposite side. The depression in which it flows is called its *bed*, or *channel*. Other streams uniting with it are called its *affluents*, or *tributaries*. The place where it begins is its *source*, and where it ends, its *mouth* or *dé-bouchure*. A region or district drained by a system of streams is termed a *river basin* and the division between two or more river systems is called a *divide*, or *watershed*. When two or more streams unite at the same place, as in the case of the Allegheny and the Monongahela

at Pittsburgh, they are said to form a *junction*.

Most rivers flow from higher land into lakes or into the sea, but many streams in arid countries either evaporate or the water sinks into the ground, such as the Humboldt River of the U.S. The steepest slope is usually near the source and the most gentle near the mouth, but in many instances the head streams are in a flat country, as in the case of the Mississippi, and in others the rivers flow over escarpments in the lower course, as the Potomac and other streams of the Piedmont Plain. Large quantities of earth and rock are eroded by the action of the running water, but this effect depends upon the character of the channel and the rapidity of the flow. Where the bed offers considerable resistance, as in the Niagara, great falls and rapids result. In many instances the larger rivers flow into the sea or lakes by a slow current, as the Nile and the Mississippi, which gives rise to deltas. This is true likewise of the St. Lawrence, but it has no delta for the reason that the silt is dispersed or carried away by high tides or oceanic currents.

Rivers are of vast importance in the history of mankind, since they supply means of transportation and drainage, thus causing the rise of important cities and the growth of nations. They were even more important in the economic and political conditions of nations formerly than at present, since the building of railroads has made it possible for many manufacturing and commercial cities to develop importance even at considerable distances from the ocean or rivers, though nearly all the great cities of the world are supplied with water navigation facilities.

Below is a table showing the length and area of some of the principal rivers:

RIVER	MILES IN LENGTH	AREA OF BASIN (SQ. M.)
Mississippi-Missouri, N.A.	4200	1,250,000
Nile, Africa	4000	1,100,000
Amazon, S.A.	3400	2,500,000
Yang-tse Kiang, Asia	3300	650,000
Congo, Africa	3000	1,500,000
Lena, Asia	2800	900,000
Cambodia, Asia	2800	955,500
Amur, Asia	2700	780,000
Hoangho, Asia	2600	400,000
Niger, Africa	2600	600,000
Mackenzie, N.A.	2525	680,000
Mississippi, N.A.	2500	725,000
Obi, Asia	2500	1,125,200
Irtish, Asia	2310	412,000
Volga, Europe	2300	563,300
Yukon, N.A.	2300	330,000
Colorado, N.A.	2000	250,000
Rio Grande, N.A.	2000	240,000
Brahmaputra, Asia	1800	425,000
Indus, Asia	1800	372,000
Danube, Europe	1750	300,000
Tocontins, S.A.	1700	350,000
Murray, Australia	1450	270,000



Collection Museum of Modern Art, N.Y.
Gift of Mrs. John D. Rockefeller, Jr.

THE OFFERING. PAINTING BY DIEGO RIVERA

Rivera (*rê-vâ-râ*), DIEGO, painter, born in Guajalajara, Mexico, Dec. 8, 1886; died in Mexico City, Nov. 25, 1957. He began to paint at the age of ten. During his later study in Europe, he was influenced by the paintings of El Greco and Goya and by the moderns (e.g., Cézanne and Picasso). Returning to Mexico in 1921, Rivera helped to start a government project for decorating public buildings with murals illustrating Mexican history. He visited the U.S.S.R. in 1927-28 and later joined the Communist party. From 1930 to 1934 he painted murals in New York, San Francisco, and Detroit. A mural he painted for Rockefeller Center in New York City caused much controversy because it included a likeness of Lenin.

River Brethren (*rîv'êr brêTH'rên*), known as Brethren in Christ since 1862, any of several Christian sects which originated (1770) in a revival movement among the German settlers of eastern Pennsylvania. Similar in doctrine and habits to the Dunkards (*q.v.*), the River Brethren received their name from the fact that they lived near the Susquehanna River and were baptized in its waters. They practice foot washing and trine immersion, wear plain clothing, and are opposed to warfare, worldly pleasures, and the use of alcohol, tobacco, and stimulants. In 1954 the Brethren in Christ maintained 112 churches and had a membership of 5,950.

River Plate (*rîv'êr plât*), an estuary of South America. See *Plata, Río de la*.

Riverside (*rîv'êr-sîd*), county seat of Riverside County, California, 10 m. s.w. of San Bernardino. It is on the Atchison, Topeka & Santa Fe and other railroads and is a processing and shipping center for citrus fruits. The navel orange was introduced here from Brazil in 1873. Riverside is the seat of a citrus experiment station of the Univ. of California, of one of the campuses of that institution, and of Riverside Coll. Annual Easter sunrise services are held on Mt. Rubidoux, west of the city. Nearby are Sherman Indian Inst. and March Field, a U.S. Air Force base. Riverside was founded in 1870 and incorporated

ROAD

in 1883. Population, 1900, 7,973; in 1950, 46,764.

Rives (*rêvz*), AMÉLIE, PRINCESS TROUBETZKOY, author, born in Richmond, Va., Aug. 23, 1863; died in Charlottesville, Va., June 15, 1945. She married (1888) John A. Chanler, from whom she was divorced seven years later, and in 1896 married Prince Pierre Troubetzkoy, an Italian-born Russian émigré who came to the U.S. in his early thirties. Among her novels are "The Quick or the Dead?" (1888), "The World's End" (1913), and "Firedamp" (1930). She also wrote several volumes of poetry and a number of plays.

Riviera (*rîv-î-âr'q*), the name for the coastal region of southeastern France and northwestern Italy, extending ca. 225 m. from Hyères, France, to La Spezia, Italy. The region is a famous winter resort with a temperate, sunny climate; citrus fruits, grapes, and olives are grown here. There are three subdivisions of the Riviera: the French Riviera, or Côte d'Azur; the Riviera di Ponente, which comprises the Italian Riviera west of Genoa; and the Riviera di Levante, that section east of Genoa.

Rizaiyeh (*rê-zû-ê-yâ'*) or REZAIH, formerly Urmia, a city of northwestern Iran, the capital of the Fourth Province, about 50 m. s.w. of Tabriz. It is a trading center for the fertile surrounding region, which produces cotton, grain, fruits, and tobacco. Manufactures include carpets, clothing, furniture, and earthenware. The inhabitants are mostly Turkomans. Rizaiyeh is the reputed birthplace of Zoroaster. Population, ca. 50,000.

Roach (*rôch*), a small fish of the carp family, 10 to 15 in. long. The European roach (*Rutilus rutilus*) has a silvery body, with dull-green back and red lower fins. It is common in North Europe.

Road (*rôd*), an open way, a track for travel or for conveying goods from one place to another. A main road is usually called a highway. The construction of roads and highways is a matter of public concern and varies according to the state of civilization and the resources of the country through which they pass.

Highways of an excellent quality were built by the Romans. The Appian Way, one of the oldest and most celebrated of the early Roman roads, was commenced in 312 B.C. It is still one of the principal roads leading into Rome. Roman roads were paved with blocks of stone resting on a foundation of rough stones consolidated into one mass by mortar or grout. Because of their solid construction—often 3 ft. or more in thickness—remnants of many of the roads built by the Romans still exist. In some instances they have served as the foundation for more modern roads. In England several sections of Roman road that had fallen into disuse have been reopened and modernized since 1920. A remarkable feature of Roman roads was their general

straightness. They appear to have been laid out on a straight course from point to point between centers of population, without regard for obstacles that might easily have been avoided.

Road-building practices established by the early Romans were not generally adopted by other nations because of the great amount of labor required to build them. Roads in Europe remained incredibly bad throughout the Middle Ages and up until modern times. After the rise of the western powers, France and Germany took the lead in road building and many new roads were constructed in those countries, but there was no marked improvement of European roads before the 19th century.

During the 19th century progressive nations began to realize the importance of highway transportation. Progress in road building was accelerated during the first quarter of the 20th century, after the advent of the automobile. Today there is world-wide recognition of the necessity of a good system of highway transportation in every country that is to be prosperous.

A large portion of the roads in Latin-American countries are still in very poor condition. For the most part they are donkey trails or ox-cart roads. But there are notable exceptions, as in Argentina, Brazil, Cuba, and Mexico, where many of the highways are well graded and surfaced. The Pan American Highway System (*q.v.*), which is being developed in Latin America, and the Inter-American Highway through Mexico and countries in Central America, on which work was begun before World War II, eventually will make it possible for travelers to drive over well-paved roads from the U.S. down the west coast of South America, across Argentina, and up to Rio de Janeiro, Brazil. Many sections of the Inter-American and Pan-American Highways have been completed but there are still several impassable gaps.

The importance of good roads was emphasized anew during World War II. Highways played a large part in all military operations. Capture of islands in the Pacific was greatly aided by the ability of Americans to build roads rapidly to camps and airfields, and behind advancing forces. After the Allied troops landed in Normandy, the "Red Ball Express" route for top priority traffic going to the front was probably the busiest stretch of highway in the world. On this route from the beaches of Normandy to the fighting front an endless stream of traffic moved over the two-lane roads in one direction only, going up one road and returning on another. The Alaska Highway was constructed through over 1,400 m. of wilderness to meet a possible invasion of Alaska. Supplies for British troops battling Rommel's forces in North Africa were hauled over a hastily constructed highway from an East Africa

port to the Upper Nile, then transported by boat down the Nile to depots behind the British lines. The famous Burma Road, built by Chinese, and an extension called the Ledo Road, built by U.S. Army engineers and native laborers, played an important part in defeating the Japanese in south-east Asia. Military supplies carried by truck over these roads contributed materially to the eventual defeat of Japan. Another important strategic road, constructed as a wartime necessity, was the army-built highway from Alice Springs to Darwin on the northern coast of Australia.

In road building it is necessary to take into account such natural obstructions as streams, swamps, and hills, which call for bridges, embankments, deep excavations, or tunnels. In the early days of highway construction the breadth of the right-of-way usually was 66 ft., or 4 rods, but modern road-building practices call for a right-of-way of 100 to 300 ft. or more. The width of the road surface depends upon the volume of traffic.

Government agencies to plan and supervise the building of good roads are maintained in nearly all countries. Under their direction new road-building methods are studied and standards are established for building road surfaces, culverts, grades, bridges, and other improvements that enter into the construction of a good road. Modern highways embody many engineering improvements and safety devices, such as easy curves and grades, wide traffic lanes, improved shoulders, overpasses, routes by-passing cities, etc. In North America it is customary for the driver to keep to the right when meeting vehicles but in a number of countries the opposite rule is followed. On roads that cross each other the right of way belongs to the driver who is approaching from the right. A person must know all the traffic rules before he is permitted to drive a motor vehicle.

In most civilized countries the network of modern highways, serving vast automobile, bus, and truck traffic, represents a large governmental expenditure for scientific research, planning, construction and maintenance. See *Highway*.

UNITED STATES. Road building in the U.S., from the old pioneer trails to the present-day system of modern highways, has undergone many changes. Construction of pioneer roads was undertaken when settlers no longer could find good lands along waterways and began to push their way inland, but the early roads were hardly worthy of the name. At the time of the Revolutionary War the colonists had settled a narrow strip of land some 150 m. wide, bordering on the Atlantic coast and bounded on the west by the Appalachian Mts. Nearly all road development was in this area. The present Boston Post Road had its origin in the Post Road of colonial days.

The most important development in highway construction in the U.S. after the Revolutionary War was the construction in 1795 of a 62-m. stretch of surfaced highway from Philadelphia to Lancaster, Pa., at that time a section of the main north-south highway between Philadelphia and Baltimore. The surfacing of this road with stone marked the first extensive construction of a hard surface suitable for use throughout the four seasons of the year. This was the first step toward removing the mud blockade of travel in winter months. By 1802 through freight-wagon and stagecoach services were in operation between Boston and Savannah, a distance of 1,200 m. The stages covered this distance, at the astonishing speed of 53 m. a day, in a total of 22½ days. Food and lodging for the passengers were provided by taverns along the route.

By this time the territory beyond the Ohio River had been opened to settlement, and the pioneers with their scanty household belongings thronged the trails across the Appalachian Mts. into the new "northwest" country. The most important westward line of travel had become well defined, and in 1806 Congress appropriated funds for its improvement. This was the first Federal appropriation for road construction. The road, known as the National Pike, extended from Cumberland, Md., across the Appalachian Mts. to Wheeling, then in Virginia. It was later projected westward through the state capitals of Ohio, Indiana, and Illinois, to St. Louis, on the Mississippi River, but was not completed to its terminus. Today this road is a section of U.S. Route 40, an outstanding transcontinental east-west highway.

In the late 18th and early 19th centuries, the East experienced the era of the turnpike. A few

of the turnpikes were public enterprises, but most of them were private toll roads. At that time, only a few roads in the entire country, with the exception of the turnpikes, had smooth surfaces. Most of them were earth roads, almost impassable in winter, and the smaller streams had to be forded. Except for the turnpikes, the main highways were not as good as unsurfaced country roads are today.

The westward trek of settlers between 1800 and 1850 led to the opening of many trails which later were developed into transcontinental routes. Noted among the early trails of the West were the Santa Fe, the Overland, the Oregon, and the Mormon Trails. These historic Western trails were not improved roads in any sense of the word. The first pioneers simply set out in the general direction of their destinations, seeking a route where streams could be forded and probing for passage through the lowest mountain passes. No work was done to improve the roads across the prairie and desert, and in the mountains only serious obstacles were removed. With the discovery of gold in California in 1849, thousands of men started on the long and perilous overland journey with the hope of finding wealth in the gold fields. Many of them followed the Oregon Trail to a point north of Salt Lake City, where they branched off on the California Trail leading to San Francisco.

Although the rapid development of turnpikes during the first quarter of the 19th century made it possible for travelers to journey by stagecoach throughout the Atlantic seaboard and far into the West, the great expansion of the railroads (from the 1830's on to the end of the century) retarded further growth of the highway movement.

URBAN TRAFFIC ARTERIES

The New York approach to the George Washington Bridge (left) shows traffic from New Jersey heading, through the tunnel in the background, for metropolitan highways. The Baltimore-Washington Parkway is at right





MODERN HIGHWAY CONSTRUCTION

The cloverleaf exchange is exemplified in this section (top) of U.S. 50 between Annapolis, Md., and Washington, D.C. The East Bridge of MacArthur Causeway (center), across Biscayne Bay, is approached from Miami Beach, Fla., by a left-turn viaduct structure. Interstate highways, such as this one through Providence, R.I. (left), pass through cities by means of elevated structures.

The era of modern road building began with the invention of the gasoline automobile in 1893. By 1900 there were 8,000 motor vehicles in the U.S.; 20,000,000 in 1925; and by 1958 registrations had reached 68,000,000. The estimate for 1975 exceeds 100,000,000.

About 1890 the states began to assume responsibility for construction and repair of main roads. This process was accelerated in 1916 when the Federal government adopted the policy of granting Federal-aid money to the state governments for road construction.

Total rural road mileage reached 3,000,000 soon after World War I and has not increased greatly since. The major and continuing need has been for improved roads and streets, with greater carrying capacity—especially in and around large urban areas.

Currently, there are 3,064,000 m. of rural roads in the U.S., of which 1,085,000 m. are paved, including 493,000 m. of high-type bituminous or Portland cement concrete; another 1,286,000 m. are reinforced with stabilized soil or with gravel or stone. This rural mileage includes 391,000 m. in the state primary systems—the main routes carrying most of the traffic. The individual counties control 1,726,000 m. of secondary roads, and 561,000 m. are controlled by town and city governments. There are 389,000 m. of city streets, largely under city jurisdiction, although about 45,000 m. of principal streets and urban expressways are within the state highway systems. The Federal government currently maintains 99,000 m. of roads in national parks and national forests—the only national roads in the sense that they are actually owned by the Federal government.

Federal aid to the states for highway construction began modestly in 1916. From 1921 such aid was limited to a system of major roads selected by the states and joined at state lines to promote a connected highway network. Beginning in 1944, Federal aid was extended to urban highways and to secondary or farm-to-market roads. There are currently *ca.* 800,000 m. of road eligible for Federal aid, 256,000 m. on the primary system and 553,000 m. on the secondary. Federal aid for these systems (including urban extensions) is divided among the states according to formulas which weigh the relative area, population, and rural-mail-route mileage of each state. Federal aid is used only for construction and right-of-way acquisition; maintenance and operation are the responsibilities of the states. The states select the roads to be improved, decide what projects to build, prepare the plans, let the contracts, and supervise the construction—all subject to approval by the Federal government.

Federal highway functions are carried out by

the Bureau of Public Roads of the U.S. Dept. of Commerce. In addition to administration of Federal aid, the bureau carries on extensive research dealing with highway planning, construction, economics, and use.

Regular Federal aid for highways has risen from a token \$5,000,000 in 1917 to authorizations of \$875,000,000 for 1959, \$900,000,000 for 1960, and \$925,000,000 for 1961. The money is divided 45 per cent for the Federal-aid primary system, 30 per cent for the secondary system, and 25 per cent for their urban extensions. These funds must be matched in equal amount by the states.

The Federal-Aid Highway Act of 1944 introduced a new system concept and called for the designation of a 40,000-m. Interstate System network linking important cities from coast to coast. But as this act did not provide special-aid funds, progress was slow.

The Federal-Aid Highway Act of 1956 gave direction and purpose to the earlier proposal. Federal funds totaling over \$25,000,000,000 were authorized for the years 1957-69 to complete a 41,000-m. National System of Interstate and Defense Highways. Though comprising only 1.2 per cent of the total road and street mileage in the U.S., it will serve 20 per cent of the total traffic when it is completed. The Congress recognized the national importance of the system by providing that the states would put up only \$1 for every \$9 of Federal aid.

By definition, the Interstate System is a part of the Federal-aid primary system, thus the states select the routes and plan and arrange for construction of the projects on the Interstate System. By the end of 1958, 4,700 m. had been built and opened to traffic. An additional 6,800 m. were under way, and planning or right-of-way acquisition had started on another 16,800 m.

This network is being built to design standards which will be adequate for 1975 traffic. Most of the system will be divided four-lane highway, but six or more lanes will be needed in and near large cities. Lanes will be at least 12 ft. wide, the dividing strip generally 36 ft. or more. Grades, sight distances, and curvatures will provide optimum conditions for safe and efficient traffic movement.

A most significant feature of the Interstate System is access control. This means that vehicles entering and leaving the main traffic streams will do so only at planned interchanges having grade separations and ramps which will permit safe, orderly exit and entrance, with no direct interference from abutting property, driveways, roads or places of business.

Highway finances are compatible with the contribution motor vehicles make to the general economy and way of life. Total expenditures for roads and streets in 1959 came to \$10,500,000,000.

Of this sum, \$7,100,000,000 went for capital outlay—construction and purchase of right-of-way—and \$2,300,000,000 was for maintenance; the remainder was for administration, highway police and safety activities, and interest on debt. The total included \$7,100,000,000 spent for state highways and \$1,700,000,000 for county and other rural roads, with \$1,400,000,000 for city streets.

Total highway revenues, which reached \$10,800,000,000 in 1959, included \$3,000,000,000 of Federal funds, \$5,600,000,000 from state governments, \$808,000,000 from county and other local rural governments, and \$1,400,000,000 provided by cities and other urban places. The Federal funds derive originally from the Federal excise taxes on highway users. In addition, \$4,400,000,000 annually came from state gasoline taxes, motor-vehicle registration fees and the like; tolls supplied \$450,000,000; \$1,500,000,000 came from property taxes and general revenue; and \$177,000,000 came from miscellaneous sources.

In the first three years of the greatly enlarged highway program, which began July 1, 1956, construction was completed on more than 75,000 m. of Federal-aid highways and 15,000 bridges.

See also separate articles on individual roads and highways, e.g., *Pennsylvania Turnpike*.

Road Runner (*rōd' rūn-ēr*), a bird of the cuckoo family, found in the more arid regions of the southwestern U.S., Mexico, and Central America. It lives on the ground and is called road runner because it has big legs and prefers to run rather than fly. It is also called snake killer, as it kills many small snakes, including rattlesnakes.

Roanoke (*rō'q-nōk*), a river of the U.S., formed in southern Virginia by the confluence of two forks. Its upper course was formerly named the Staunton River. It takes an eastern and southeastern course, is joined by the Dan, crosses into North Carolina, and flows into Albemarle Sound. Its total length is 380 m., and it is navigable for ca. 200 m.

Roanoke, a city in Virginia, seat of Roanoke County, on the Roanoke River, 168 m. w. of Richmond. It is served by the Norfolk & Western and the Virginian R.R.'s. Woodrum Field, the municipal airport, is ca. 5 m. n.w. of the heart of the city. With an area of 26.6 sq. m., Roanoke lies in the valley between the Blue Ridge Mts. and Allegheny Mts. Its recreational system covers ca. 1,000 acres, including more than 30 parks. Jefferson National Forest is to the northwest. Among points of interest are Mill Mt., which is topped by a neon-lighted star and is the site of a children's zoo; the Wildheim Game Farm, west of the city; and the Blue Ridge Parkway, which follows the crests of nearby mountains for more than 400 m. The city is

the site of a veterans' hospital, opened in 1934.

Roanoke is surrounded by an agricultural region that produces fruits, poultry, livestock, and dairy products; deposits of limestone and clay also are exploited. Its diversified manufactures include railroad cars, textiles and apparel, furniture, metal and wood products, plastics, and electrical components. It is the center of a standard metropolitan area that includes all of Roanoke County (303 sq. m.; pop., 1950, 133,407) and that in 1954 had a value added by manufacture of \$62,923,000; the figure for the city alone was \$47,338,000.

Roanoke's more than 30 public elementary and secondary schools enroll ca. 18,500 pupils annually. Its institutions of higher learning include Hollins Coll., Roanoke Coll., and the Univ. of Virginia Extension Division. Cultural facilities include the Roanoke Fine Arts Center and the Roanoke Symphony Orchestra. Roanoke is an independent city, governed by a city manager and a council of seven members.

The first settlement on the site of Roanoke was established ca. 1798 and called Big Lick. Other settlements sprang up in the vicinity but were abandoned. In 1852 the first railroad came to Big Lick, the town was incorporated in 1874, and in 1882 the name was changed to Roanoke, an Indian word meaning "money." Incorporation as a city came the following year.

In 1890 Roanoke had a population of 16,159. Its period of greatest growth was the decade 1940-50, when the population increased from 69,287 to 91,921. In 1958 it was estimated at 106,500.

Roanoke Island, an island 12 m. long on the coast of North Carolina, between Albemarle Sound and Pamlico Sound. Politically a part of Dare County, it is the site of the county seat, Manteo. The island was the site of the earliest English settlement in the New World, which was attempted by Sir Walter Raleigh (*q.v.*) in 1585 at Ft. Raleigh, at the northern end of the island, and lasted only ten months. The second settlement at Ft. Raleigh, subsequently known as the Lost Colony, was established in 1587 under the governorship of Capt. John White. Detained in England for three years by war with Spain, White returned to the colony in 1591 to find all the colonists had disappeared (see also *Dare, Virginia; North Carolina*). In the Civil War, Union forces under Gen. Ambrose Burnside captured the island's Confederate garrison on Feb. 8, 1862.

Robbery (*rōb'ēr-ē*), the crime of taking money or goods from the person of another, or in his presence, against his will, with force or violence. It differs from larceny in that robbery is accompanied by violence or intimidation and is committed in the presence of the owner. This

crime is termed *highway robbery* when it is committed by taking property from travelers. The punishments are various, depending upon the conditions under which the offense is committed. If the offender is armed with a dangerous weapon at the time of such robbery the penalty is severe. In most cases an assault with an intent to rob is punishable by confinement in prison. Robbing or attempting to rob a passenger train is punishable in some countries by imprisonment for life.

Robbia, DELLA (*röb'byä, däl'lä*), the name of a celebrated family of Italian sculptors, whose members produced many fine works of Florentine art. Luca della Robbia (1399-1482) is noted as the originator of famous terra cotta pottery products characterized by a distinctive enameled luster. Practically his entire life span was spent in Florence, where his most famous work is the "Singing Gallery," executed for the cathedral between 1431 and 1440. Ten panels of singing, dancing children, full of movement and life, prove the great mastership of Luca della Robbia. In addition to these relief panels, his name is connected with the five allegorical reliefs he was

commissioned to do for the Campanile of Florence, where Giotto and Andrea Pisano had done sculptured work before him. Another great commission was the decoration and design for the bronze doors to one of the sacristies of Florence Cathedral, executed with all the charm and dignity of the early Renaissance artist.

ANDREA DELLA ROBBIA (1435-1525), Luca's nephew and pupil, continued his work in enameled terra cotta, and innumerable reliefs from his hand have come down to us. His name will always be associated especially with the series of medallions representing infants, white on a blue ground, created to decorate the front of the Foundling Hospital in Florence. The composition is in the form of a frieze, but each one of the infants differs from all the others. In the composition of his Madonna reliefs, Andrea's style is richer, not only in ornament, but also in the enlarged color palette used for the terra cotta work, with more yellow, brown, and green included.

Among the five sons (out of seven) of Andrea della Robbia, only one, GIOVANNI DELLA ROBBIA (1469-1529?), has become better known individually, although it is often difficult to distinguish just which is his work and which belongs to his father.

Robert I (*röb'ert*), King of Scotland. See *Bruce*.

Robert II, King of Scotland, born Mar. 2, 1316; died Apr. 19, 1390. He was the son of Marjory, daughter of Robert Bruce, and Walter, steward of Scotland, hence the first of the Stuart kings. Both his parents died while he was yet an infant, but he was recognized as heir to the crown by parliament in 1318 and, after the death of David II, in 1371, was formally crowned at Scone. In 1384 Scotland was invaded by the Duke of Lancaster, and the English made a second invasion under Richard II in 1385. Robert made a retaliatory expedition into England in 1388, which culminated in the Battle of Otterburn on July 21, 1388.

Robert III, King of Scotland, eldest son of Robert II, born in 1340; died Apr. 4, 1406. He was crowned king in 1390. As a result of his imbecility the government at first rested largely in the hands of his brother, Earl of Menteith. Scotland was invaded by Henry IV of England in 1400, but he soon withdrew his forces. The following year a Scots army under Archibald Douglas made an expedition into England, which resulted in the defeat of the Scots at the Battle of Homildon Hill, in 1402. James, second son of Robert, was sent to France in 1406, but was captured by the English and retained for some time as a prisoner by Henry IV. This so grieved the king that he died, probably at Rothsay, soon after.



SINGING GALLERY

RELIEF BY LUCA DELLA ROBBIA

Roberts (rōb'erts), BRIGHAM HENRY, Mormon leader, born in Warrington, England, Mar. 13, 1857; died Sept. 27, 1933. He came to the U.S. in 1866 and settled in Utah, where he was graduated from the Utah Univ. in 1878. Being a member of the Mormon Church, he married three times before polygamy was abolished in 1890. He served as a member of the Utah constitutional convention in 1895 and in 1898 was elected to Congress, but opposition to his admission as a member on account of his polygamous relations soon arose. This opposition took form in a petition signed by 7,000,000 persons. Roberts defended his claim for admission with marked ability, but when it came to a vote, in 1900, he was excluded on roll call, the vote being 268 in favor of exclusion out of a total of 318. Roberts contributed to periodicals and magazines and traveled extensively. Among his works are "Life of John Taylor, Third President of the Mormon Church," "New Witness of God," "The Gospel," and "A Comprehensive History of the Church of Jesus Christ of Latter Day Saints, Century I."

Roberts, SIR CHARLES GEORGE DOUGLAS, poet, born at Douglas, New Brunswick, Jan. 10, 1860; died Nov. 26, 1943. He studied at the Fredericton Collegiate School and subsequently at the Univ. of New Brunswick. In 1883-84 he edited *The Week* at Toronto and in 1885 was made professor of English and French literature in King's Coll., Nova Scotia. Two years later he was named professor of economics and international law. He resigned in 1895 to devote himself to literary work. In 1897 he joined the staff of the *Illustrated American*, published in New York, and, in 1937, took over the editorship of the "Canadian Who's Who." Many of his writings deal with animal life. His works in prose include "By the Marshes of Minas," "Around the Camp Fire," "The Forge in the Forest," "The Kindred of the Wild," "The Heart of the Ancient Wood," and "A History of Canada." He produced a number of poetic works, including "Songs of the Common Day," "In Divers Tones," "Orion and Other Poems," and "Books of the Native." Roberts was considered the leading Canadian poet of his time and played an important role in the development of a Canadian literary literature.

Roberts, KENNETH LEWIS, author, born in Kennebunk, Me., Dec. 8, 1885; died in Kennebunkport, Me., July 21, 1957. He was educated at Cornell Univ. and afterward became a member of the staff of the *Boston Post*, where he remained from 1909 to 1917. He spent several years on the editorial staffs of the humorous magazines, *Puck* and *Life*, and was a staff correspondent for *The Saturday Evening Post* (1919-37). Known primarily for his historical novels, Roberts is the author of "Arundel" (1930), "The Lively Lady" (1931), "Rabble in Arms" (1933), "Captain

Caution" (1934), "Northwest Passage" (1937), "Oliver Wiswell" (1940), "Lydia Bailey" (1947), "I Wanted to Write" (1949), "The Seventh Sense" (1953), and "Boon Island" (1956).

Roberts, OWEN JOSEPHUS, jurist, born in Philadelphia, Pa., May 2, 1875; died in Phoenixville, Pa., May 17, 1955. He was educated at the Univ.



Courtesy Brown Bros., N. Y.

OWEN J. ROBERTS

of Pennsylvania, where he received the A.B. in 1895 and the LL.B. in 1898. Beginning his practice in Philadelphia in 1898, he also taught law at the Univ. of Pennsylvania (1898-1918). During World War I he prosecuted espionage cases in the eastern district of Pennsylvania, and in 1924 investigated the Teapot Dome Scandal for the government. He became an associate justice of the U.S. Supreme Court in 1930, serving until 1945, when he retired. In 1941 President Franklin D. Roosevelt appointed him to investigate the Pearl Harbor disaster. In 1948 he became dean of the Univ. of Pennsylvania law school, which he headed until 1951.

Robertson (rōb'ert-sūn), JAMES, soldier and pioneer, born in Brunswick County, Virginia, in 1742; died in 1814. His parents moved to North Carolina, where he became acquainted with Daniel Boone. In 1770 he accompanied the latter on a trip into Tennessee, where he aided in founding the Watauga Association, which was the first compact to form a government west of the Allegheny Mts. He was an influential member of the settlement and was conspicuous in operating against the Indians. In 1778 he and Richard Henderson purchased a tract of land and founded the city of Nashville, which later became the capital. He was made brigadier general when Tennessee was organized as a territory in 1791, and after its admission as a state he served in the legislature. In the War of 1812 he

did much to retain the friendship of the Indians and prevent them from joining the British.

Robeson (*rōb'sūn*), PAUL, Negro singer and actor, born in Princeton, N.J., April 9, 1898. After being graduated from Rutgers Univ. (1919), and taking a law degree at Columbia Univ. (1923), he embarked on a stage career. Notable among his performances were "Emperor Jones" (1923), "Othello" (1930, 1943), and "The Hairy Ape" (1931). His first appearance as a concert baritone was in New York (1925). Thereafter he toured Europe, America, and Russia. He appeared in motion pictures as well. Active in behalf of the abolition of race discrimination, he became a controversial figure in the U.S. after World War II. The public expression of his belief that the U.S.S.R. had more to offer to the American Negro than had the U.S. resulted in a State Dept. refusal to issue a passport to him for foreign travel until 1958.



ROBESPIERRE

Robespierre (*rō'bēs-pēr*), MAXIMILIEN MARIE ISIDORE, statesman, born in Arras, France, May 6, 1758; guillotined July 28, 1794. After studying in the schools of his native town he studied and was graduated from the Coll. of Louis-le-Grand in Paris. Later he studied law and established himself as an advocate in Arras. In 1789 he was elected a deputy to the assembly of France. Though a man of small stature with a shrill voice, he was a powerful orator and exerted himself as a leader of revolutionary clubs, particularly of the Jacobins (*q.v.*). It has been said that he represented the spirit and history of the French Revolution (*q.v.*) after the death of Mirabeau. In 1791 he became public prosecutor before the

Paris tribunal. It has been suggested that he planned the massacres of 1792, remaining in the background, however, and leaving it to Jean Paul Marat and Georges Jacques Danton (*qq.v.*) to carry out his designs. Robespierre was elected first deputy of Paris in the same year and shortly thereafter became a member of the National Convention, which was to determine the fates of Louis XVI and Marie Antoinette (*qq.v.*).

As a member of the Montagnard faction of that body, Robespierre was tireless in his efforts to secure the execution of the king, whom he considered a traitor to the nation after Louis' unsuccessful attempt to escape. In 1793 followed his memorable contest with the Girondists (*q.v.*). In this struggle, Robespierre was supported by many leaders anxious to defend France in its contest with Europe—with little regard for personal questions. He was elected to the Committee of Public Safety (*q.v.*) in July 1793. He split thereafter with Jacques Hébert (*q.v.*) and his associates, who were guillotined by a vote of the convention on March 24, 1794. Robespierre also differed with Danton and Camille Desmoulins (*q.v.*), who were brought to the guillotine on April 5, 1794. Influential in the Paris Commune, Robespierre made a frightening speech in the convention on the 8th Thermidor (July 26), threatening the enemies of the revolution. Because he did not mention any names, almost everyone, including his supporters, felt endangered, and a party formed in the convention in opposition to him. He was publicly accused of despotism on July 27, 1794, and thrown into Luxembourg prison. Rescued by the Commune, he was rearrested by an armed force under the Comte de Barras (*q.v.*). He was taken before the tribunal, where he was speedily convicted as an outlaw. He was guillotined the same day (July 28), along with many of his supporters, among them Antoine de Saint-Just (*q.v.*) and Georges Couthon, an event which marked the end of the Reign of Terror.

Although variously described by historians, Robespierre was universally recognized as incorruptible. He excelled many of his co-revolutionists intellectually and as a political tactician, but he was, nevertheless, a fanatic and eager for power. He was frequently accused of possessing a disregard for all personal attachments. A dedicated proponent of Rousseau's philosophy, Robespierre was responsible for introducing the official worship of a "Supreme Being," a type of state deism (*q.v.*).

Robin (*rōb'in*) OF ROBIN REDBREAST, the name applied to several species of European warblers. The American robin, however, is a thrush. Belonging to the species *Turdus migratorius*, it is much larger than the European birds. It is 10 in. long, has a black head and back, and the breast

ROBIN HOOD

is chiefly of an orange color. The female is duller in color than the male. It is migratory, reaching the Northern states and Canada in the spring. Two broods of young are reared each year, usually from four to six in each brood, and they return northward to breed the following season. Robins are familiar birds with a pleasant song.

Robin Hood (rōb'in hōōd). See *Hood, Robin*.

Robinia (rō-bin'i-ā), a genus of shrubs and trees. The locust tree, also called "false acacia," is the most important species. Native of North America, it yields valuable timber for cabinet work. Due to its fast growth, it is easily grown as a hedge and can be clipped in any fashion.

Robinson, JACKIE (JACK ROOSEVELT), baseball player, business executive, born in Cairo, Ga., Jan. 31, 1919. During his youth in Pasadena, Calif., he starred in school sports. After attending the Univ. of California at Los Angeles, in 1941 he played professional football. He served in the Army (1942-45), reaching the rank of 1st lieutenant. The first Negro member of a major-league team, he accepted (1945) an offer from the Brooklyn Dodgers baseball club; in 1949 he was voted the most valuable player of the National League. In 1957 Robinson retired from baseball and entered private industry.

Robinson Crusoe (rōb'in-sūn krōō'sō), hero of the novel of the same name, by Daniel Defoe. See also *Juan Fernandez*.

Robinson, EDWARD, museum director, born Nov. 1, 1858, in Boston, Mass.; died in New York City Apr. 18, 1931. He was educated at Harvard Univ. and at the Univ. of Berlin. In 1885 he became curator of classical antiquities at the Boston Museum of Fine Arts, where he remained until 1905, serving as director during his last three years there. He was appointed assistant director of the Metropolitan Museum of Art, New York, in 1905 and became director in 1910, a position he held until his death. Robinson's special interest was the field of classical antiquities. He helped many U.S. museums select and arrange their collections of antiquities and casts and often wrote the catalogues for such exhibits. He taught archaeology at Harvard, 1893-94, 1898-1902.

Robinson, EDWIN ARLINGTON, poet, born at Head Tide, Me., 1869; died in 1935. He removed to Gardiner, Me. (1870), to New York City (1897), and spent his summers writing at Peterboro, N.H. (after 1911). His poetry includes: "The Torrent and the Night Before" (1896), "The Town Down the River" (1910), "The Man Against the Sky" (1916), "Lancelot" (1920), three Pulitzer prize-winners, "Collected Poems" (1921), "The Man Who Died Twice" (1924), and "Tristram" (1927); "Sonnets" (1928), "Matthias at the Door" (1931), and "Talifer" (1933). He wrote two plays, "Van Zorn" (1914) and "The Porcupine" (1915).



Courtesy Macmillan, N. Y.

EDWIN ARLINGTON ROBINSON

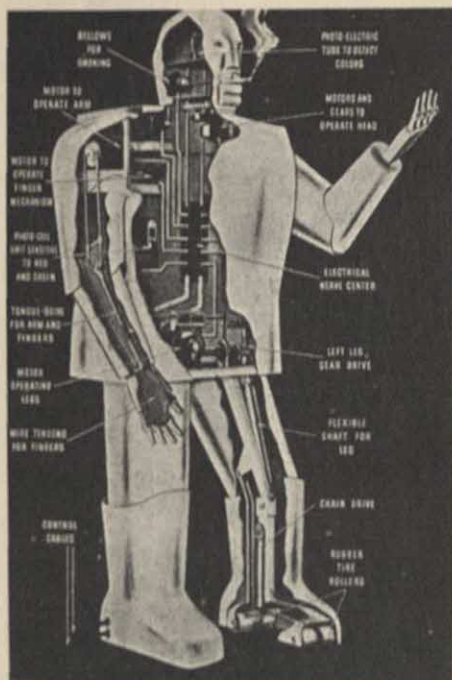
Robinson, JAMES HARVEY, historian, born at Bloomington, Ill., 1863; died in 1936. After lecturing on European history at the Univ. of Pennsylvania (1891), he was associate professor (1892-95), then professor of history at Columbia Univ. (to 1919). During the years 1919-21, he helped to found the New School of Social Research at New York City, contributing to education new, progressive methods of co-ordinating factual history with the social aspects of a given era. His writings include: "Introduction to the History of Western Europe" (1903), "The Development of Western Europe," with Charles A. Beard (1907), and "The Ordeal of Civilization" (1926).

Robinson, LENNOX, playwright, novelist, born in Douglas, Ireland, Oct. 4, 1886; died in Dublin, Oct. 14, 1958. He twice managed (1910-14, 1919-23) the famous Abbey Theater and thereafter directed its productions. His plays, mainly about Irish politics and leaders, include "The White-headed Boy" (1916), "The Lost Leader" (1918), "The Big House" (1926), "The Far-Off Hills" (1931), and "Killycreggis in Twilight" (1937). He wrote a novel, "A Young Man From the South" (1917), and an autobiography, "Curtain Up" (1942); he was editing "The Oxford Book of Irish Verse" when he died.

Robinson, SIR ROBERT, chemist, born Sept. 13, 1886. A professor of organic chemistry at Oxford Univ., England, he was awarded the 1947 Nobel prize for chemistry. The award was made for "his investigations on biologically important plant products, especially alkaloids." He is noted for his work on the structure and synthesis of natural products, and participated in experimentation leading to the development of penicillin (*q.v.*).

Robinson-Patman Chain Store Act (rōb'in-sūn pāt'man). See *Trusts*.

Robot (rō'bōt), a term coined from the Czech word *robít*, meaning "work," first used in Karel



Courtesy Westinghouse Electric & Mfg. Co., N.Y.

MODEL OF A ROBOT

Capek's play "R.U.R." ("Rossum's Universal Robots") to describe mechanical men or men turned into machines by means of repetitive or mechanical work. In the Icelandic saga of Frithjof, her ship obeyed orders and ran without a helmsman; by 1927, a steamship guided by mechanical means made a 21-day run from San Francisco to New Zealand. Albertus Magnus, Roger Bacon, Descartes, and other philosophers have built and operated mechanical men. The Televox, invented (1927) for the use of public utility companies, is capable of transmitting electric-meter readings, heights of water, positions of valves and switches, and can execute actual mechanical operations at the direction of a distant operator who uses certain tones of pitch to motivate the mechanism. Traffic systems, processing machines, and mathematical calculators are all capable of control by mechanical means, and in recent years even airplanes have been piloted by remote control (*q.v.*). See *Automation*; for robot bomb, see *Bomb*.

Rob Roy (*rōb rōi*), meaning ROBERT THE RED, outlaw, born in Scotland, 1671; died in Balquhider, Dec. 28, 1734. His true name was Robert Macgregor, but he assumed the name of Campbell because the Macgregor clan had been proscribed. In 1693 he was acknowledged as chief of the Macgregors, and he obtained a large estate on the eastern shore of Loch Lomond, where he engaged in cattle trading. In his transactions he fell into debt to the duke of Montrose and,

ROCHAMBEAU

unable to repay him, was evicted from his estates and declared an outlaw (1712). Thereafter, he resorted to plunder of the duke's estate and surrounding lands, giving to the poor a portion of what he took. In 1715 he nominally supported the Pretender (see *Jacobites*) but took no part in the war. In 1727 he was imprisoned but received a pardon just before he was to be sent to Barbados Island in the West Indies. It should be noted that he is not the hero of the novel of the same name by Sir Walter Scott.

Robsart (*rōb'särt*), AMY. See *Leicester, Robert Dudley, Earl of*.

Roc (*rōk*), or RUKH, a mythological bird of enormous size which was believed to carry off elephants to feed its young. The legend appears in Arabian and Persian mythology and throughout the lands of the East in various forms. It is in the story of "Sindbad the Sailor" in the "Arabian Nights Entertainment" (*qq.v.*). In ancient times evidence of the roc was purported to be found in the form of tusks and "quills" (which seem to have been gigantic palm fronds). For a time the home of the monster was sought on the island of Madagascar.

Roch (*rōk*), SAINT, born in Montpellier, France, ca. 1295; died there 1327. At the age of 20, after the death of his parents, he distributed his wealth to the poor and departed for Italy disguised as a pilgrim. During an epidemic of plague in Italy he miraculously cured the sick at Cesena, Rome, and other cities. He himself was finally stricken, but he recovered and returned to Montpellier, where he was arrested as a spy and imprisoned. He is invoked against the plague; his death is commemorated on Aug. 16.

Rochambeau (*rō-shān-bō'*), JEAN BAPTISTE DONATIEN DE VIMEUR, COUNT OF, soldier, born in Vendôme, France, July 1, 1725; died in Thoré, May 10, 1807. He was educated at the Jesuit college at Blois, entered the army in 1742, and served in Bavaria and Bohemia. In 1749 he was appointed governor of Vendôme but continued his military service. In 1780 he was placed in command of 6,000 French troops sent to America by Louis XVI to aid the colonists in their war against England. He landed at Newport, R.I., but was forced to remain there for a year because the French fleet was blockaded by the British in Narragansett Bay. In July 1781, he was able to leave Newport and joined Washington's army on the Hudson River. The combined forces then undertook the march on Yorktown (*q.v.*), the campaign which resulted in the surrender of Cornwallis on Oct. 19 and the successful end of the American Revolution. The U.S. Congress voted Rochambeau the thanks of the nation before his return to France. There he was made governor of Picardy and given the rank of field marshal in 1791. During the French Revolution

he commanded the Northern Army but resigned in 1792. Imprisoned, he was later released and subsequently served under Napoleon I. His memoirs of the American Revolution were translated in 1838 as the "Memoirs of the Count de Rochambeau Relative to the War of Independence."

Rochdale (*rôch'dāl*), county borough of Lancashire, England, located 10 m. n.e. of Manchester. It is situated on the Roch River and on the Rochdale Canal. It is primarily a manufacturing center, producing woolen and cotton textiles, rayon, paper, and textile machinery. Important buildings include the parish church of St. Chad (built in the 12th century) and the Archbishop Parker free grammar school, which was founded in 1565.

Rochdale saw the birth of the co-operative movement in the founding in 1884 of the Equitable Pioneers of Rochdale (see *Co-operation*). The basic tenets of later consumer co-operatives were derived from the society and have become known as the Rochdale Principles. Population, 1951, 88,429.

Rochefort (*rôsh-fôr'*), a port city in France, in the department of Charente-Maritime, 17 m. s.e. of La Rochelle. It is situated on the Charente River and near the Bay of Biscay. Jean Baptiste Colbert created a naval station here in 1666, and until the 19th century Rochefort was a chief Atlantic port. Its chief manufactures include beer, tile, and clothing; there are also some foundries and shipyards. Population, 1954, 30,858.

Rochefort, VICTOR HENRI, journalist and statesman, born in Paris, France, Jan. 30, 1830; died in Aix-les-Bains, June 30, 1913. He began his career as a journalist by contributing articles to the newspaper *Figaro* and later (1863) became its editor. In 1868 he founded and edited the journal *La Lanterne*, in which he opposed the empire of Napoleon III, but it was quickly suppressed, and he fled to Belgium. Returning to Paris in 1869, he was elected to the chamber of deputies. Rochefort then founded and edited the *Marseillaise*, a journal in which he continued his attack on Napoleon III, but it too was suppressed,

and he was briefly imprisoned; on his release in 1870, he returned to public life. He sympathized with the Commune of Paris in 1871 and, as a result, was imprisoned and banished to New Caledonia. He escaped from there to London in 1874, and later went to Geneva, but was permitted to return to France in 1880. He then founded and edited *L'intransigeant* and was twice elected to the chamber of deputies. In opposition to Léon Gambetta, he supported Gen. Georges Boulanger (*q.v.*) and was again exiled (1889-95). Upon his return, he edited the journal *La Patrie*.

Rochester (*rôch'ës-tër*), a city in Minnesota, seat of Olmsted County, on the Zumbra River, about 85 m. s.e. of St. Paul, served by the Chicago and North Western and the Chicago Great Western R.R.'s. It is surrounded by fertile farming and dairying country, and although there are some light industries—e.g., pea canning and pharmaceutical laboratories—it is primarily a medical center. Rochester is the seat of the Mayo Clinic (*q.v.*), St. Mary's and other hospitals, and of the Mayo Foundation Museum of Hygiene and Medicine. Settled in 1854, the community was incorporated in 1858. Population, 1950, 29,885.

Rochester, a city in New Hampshire, in Strafford County, on the Cochecho River, 77 m. n. of Boston, Mass. Served by the Boston and Maine R.R., Rochester is primarily an industrial community, manufacturing shoes, plastic heels, woolen goods, wood and paper boxes, and electronic sheet-metal components. Rich farmland surrounding the city is devoted chiefly to livestock and poultry raising. Incorporated as a town in 1722, Rochester was chartered as a city in 1891. Population, 1950, 13,776.

Rochester, a city and port of entry in New York, seat of Monroe County, located on the lower Genesee River and extending southward from Lake Ontario some 12 m. The city covers an area of 34 sq. m., and the river flows down over three steep falls—the highest 95 ft.—within the city limits, supplying a major share of Rochester's electric power. More than ten highway and four railroad bridges span the river, and the

COMMUNITY WAR MEMORIAL, ROCHESTER, NEW YORK

Completed in 1956 as part of a new civic center, the memorial stands on the bank of the Genesee River



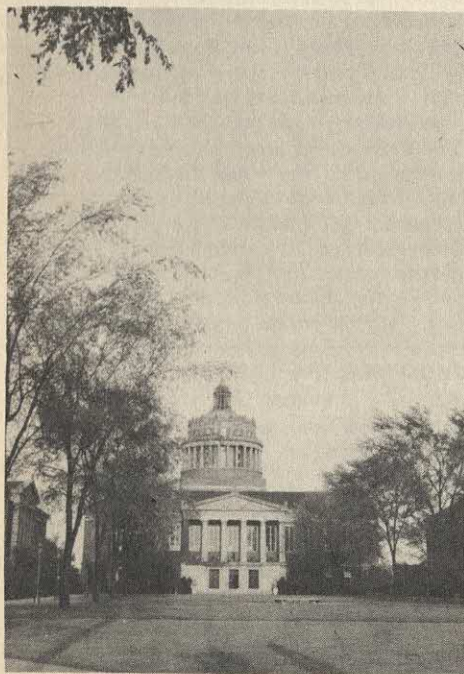
Barge Canal crosses near the southern border in a great control basin reaching north into the heart of the city.

DESCRIPTION: A manufacturing city, on the main line of the New York Central, with four minor railroad connections to the south, Rochester is best known as the home of the Eastman Kodak Co. The principal business streets are Main St., running east-west, and State and Exchange Sts. running respectively north and south from the old "Four Corners," just west of the river. East Ave. branches off from Main St. and is lined with elm trees and great mansions. Rochester's parks, of which Highland Park (107 acres) is the most famous, because of its lilacs, comprise almost one-tenth of the city's area, and trees line all of the residential streets. The Rochester and Monroe County Airport is located on the city's southwestern border, about 5 m. from downtown.

COMMERCE: In addition to technical industries such as optics, scientific equipment, and electric machinery, Rochester specializes in quality clothes for men, food processing, and the manufacture of machine tools. Because of its geographic position, the city's industrial and commercial growth is dependent upon producing quality goods. Rochester is the center of a standard metropolitan statistical area (pop., 1960, 586,387) which includes all of Monroe County. The

UNIVERSITY OF ROCHESTER CAMPUS

Courtesy New York Central System



city produced a value added by manufacture of \$1,006,462,000 in 1958.

EDUCATION AND CULTURAL INSTITUTIONS: The technology and skills required in Rochester's industries are well served by the school system, by the practical arts training at the Rochester Inst. of Technology, and the specialized science courses at the Univ. of Rochester (founded in 1850; enrollment, ca. 6,500; faculty, ca. 1,000). There are three Catholic institutions—Nazareth Coll. (women), St. John Fisher Coll. (men), and St. Bernard Sem.; the Colgate-Rochester Divinity School is Baptist-maintained. Public- and parochial-school enrollments number ca. 43,000 and 33,000, respectively.

The city's cultural facilities include the world-renowned Eastman School of Music, the Museum of Arts and Sciences, the Memorial Art Gallery, the Museum of Photography, the Historical Society, and the Society for the Preservation of Landmarks, as well as the Philharmonic and Civic orchestras and the Community Playhouse. The library system is centered in the Rundel Building, one of the first buildings to arise on the new civic center site near the downtown business district. Noted for its contribution to the spirit of international good will and its efforts in the field of public welfare, Rochester was selected by the International Advisory Council and the U.S. Information Service for the first World Brotherhood Community Award (1958).

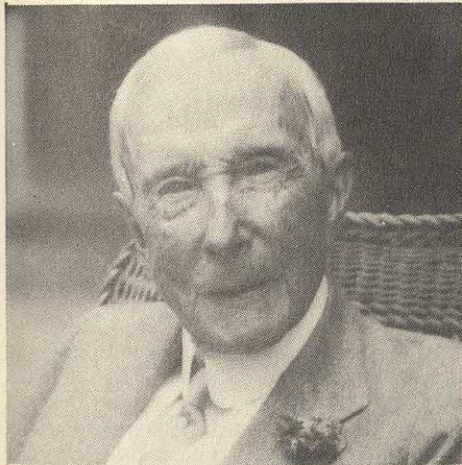
GOVERNMENT: Since 1928 Rochester has had a council-manager government. Its nine-member council, elected for four-year—overlapping—terms, chooses the mayor and a city manager for indefinite terms.

HISTORY: Rochesterville, as it was originally named (after its founder, Col. Nathaniel Rochester), had its beginning as a mill town in 1812, and for two decades after the opening of the Erie Canal (1825) it was known as the "Flour City," a name later changed (because of the active nursery industry) to "Flower City." It is also frequently called "Kodak City."

The population of the city proper has stayed around 330,000 for three decades, but Monroe County—Rochester's metropolitan district—has increased by 30 per cent during this period, reaching 579,000 in 1957. The decades of the city's most rapid growth were 1820-30 (1,500 to 9,200) and 1910-20, when the population increased by 75,000, or 30 per cent. In 1950 the population was 332,488; in 1960, 318,611.

Rockefeller (rōk'e-fēl-ēr), JOHN DAVISON, capitalist and philanthropist, born in Richford, N.Y., July 8, 1839; died in Ormond Beach, Fla., May 23, 1937. He went with his parents to Cleveland, Ohio, in 1853, and, after attending public school and a brief business course, he be-

gan work in 1855 as an assistant bookkeeper. In 1858, with his own careful savings and a gift of \$1,000 from his father, he became a partner in the produce commission business. In 1862, when he was 23, Rockefeller and a partner invested \$4,000 to enter the oil refining business, then centered in Cleveland; in 1867 they added Henry M. Flagler (*q.v.*) to the firm. The oil industry was unorganized and speculative, the price of crude petroleum rising by violent spurts and dips from 10 cents a barrel in 1862 to \$12 in 1864. Rockefeller sought by purchase and agreement to stabilize the refining and transportation of oil.



Courtesy Ivy Lee & T. J. Rose

JOHN D. ROCKEFELLER

In 1870 he formed the Standard Oil Co. (*q.v.*), retaining 26 per cent of the stock. In a dozen years the company exercised monopoly control. Yielding to court attack, the various company elements recombined into an informal association, "the original trust," the trustees holding the securities of 40 widespread companies which they operated as a unit. This organization was ordered to be dissolved in 1892, but this did not take place until 1899. From the beginning, Rockefeller dominated the giant company's policy and development. He also invested heavily in other major enterprises, railroads, banks, and the Lake Superior iron mines; he was active in forming the U.S. Steel Corp. Retiring in 1911, he increasingly turned over business matters to his son, John D. Rockefeller, Jr. (*q.v.*), while interesting himself in philanthropy. Rockefeller was recognized throughout his life for superlative business talent, vision, energy, and resolute character. The bitter criticism he incurred in earlier decades was, to a great extent, overshadowed later by his giving, especially through the Rockefeller Foundation (*q.v.*). His varied philanthropies, establishing new methods and

outlooks for such activity and handling more than \$500,000,000, include the Rockefeller Inst. for Medical Research, the General Education Board (*q.v.*), and the Laura Spelman Rockefeller Memorial (1918), which was merged with the foundation in 1929.

Rockefeller, JOHN DAVISON, JR., industrialist, philanthropist, born in Cleveland, Ohio, Jan. 29, 1874; died in Tucson, Ariz., May 11, 1960; son of John D. Rockefeller (*q.v.*). He was graduated (1897) from Brown Univ. and in 1911 assumed management of his father's interests in the Standard Oil Co. He also was active in the philanthropic organizations founded by his father. His own gifts include grants to the Riverside Church and the Lincoln Center for the Performing Arts in New York City, to scientific bodies, and to historical projects such as the restoration of Colonial Williamsburg, Va. In 1931 he founded Rockefeller Center (*q.v.*) and in 1947 donated the site for the United Nations (*q.v.*) headquarters in New York City.

Rockefeller, NELSON ALDRICH, administrator, born in Bar Harbor, Maine, July 8, 1908; son of John D. Rockefeller, Jr. (*q.v.*). After graduating from Dartmouth Coll. (1930), he became director of Rockefeller Center, Inc., and later served as its president and chairman. From 1940 to 1944 he was coordinator of Inter-American Affairs in the U.S. Dept. of State and during 1944 and 1945 a U.S. Assistant Secretary of State. He also served in the government as chairman of the Point Four foreign-aid program (1950-51), as a special assistant to the President (1954-55), and as Under Secretary in the Dept. of Health, Education, and Welfare (1953-54). Among his many civic positions of importance, he is a trustee of the Museum of Modern Art of New York City. Until April 1958 he was president of the Rockefeller Brothers Fund, Inc., which surveys the contemporary scene. In 1958 and 1962, after vigorous campaigns, Rockefeller (a Republican) was elected governor of New York State.

Rockefeller, WILLIAM, capitalist, born in Richford, N.Y., May 31, 1841; died in Tarrytown, N.Y., June 24, 1922. He began his business career as a bookkeeper but in 1865 joined his brother, John D. Rockefeller (*q.v.*), in the oil refining business. In 1867 he became head of the Rockefeller interests in New York City, primarily of the export subsidiary of what later became the Standard Oil Co. He was an able financier and promoter, and his business enterprises and investments in copper mines, many railways, and public utility corporations yielded large returns. With his great wealth he helped in the expansion of the National City Bank of New York.

Rockefeller Center, collective term for a group of buildings in New York City, which covers a total of nearly four New York City blocks,



ROCKEFELLER CENTER, NEW YORK

A "city within a city," the world's largest privately owned business and entertainment center

including the three blocks from 48th to 51st Sts. between Fifth Ave. and the Ave. of the Americas, a large portion of the 51st-52nd St. block, and a blockfront on the west side of the Ave. of the Americas between 50th and 51st Sts. The first building was started in 1931; the last of the current structures was completed in 1959. Together, the buildings cover a surface area of more than 14.5 acres (631,620 sq. ft.), of which 450,705 sq. ft. are leased from Columbia Univ. The center comprises the following buildings: The American Metal Climax Bldg., Radio City Music Hall, RCA Bldg., RCA Bldg. West, British Empire Bldg., La Maison Française, Palazzo d'Italia, International Bldg. North, International Bldg., General Dynamics Bldg., The Associated Press Bldg., Eastern Air Lines Bldg., U.S. Rubber Co. Bldg., Esso Bldg., U.S. Rubber Co. Bldg. Addition, and the Time & Life Bldg. The RCA Bldg., with its 70 stories, is 850 ft. high, one of the six tallest buildings in the world. In the offices of more than a thousand firms in the center, nearly 40,000 persons are employed. In addition to offices, there are underground concourses, restaurants, shops, exhibits, and a U.S. post office. The architecture is an example of modern functional style.

Rockefeller Foundation, THE, chartered (1913) for the purpose of promoting "the well-being of mankind throughout the world." It seeks to advance its purpose through grants to universities, research institutes, and other qualified agencies conducting work within the scope of its program. The foundation's program is concerned with certain fields in medical education and public health, biological and medical research, agriculture, the social sciences, and the humanities. For the support of its activities, the foundation appropriated, through 1961, \$735,030,792.11.

In medical education and public health, the

ROCKETRY

improvement of both medical and nursing education, medical care, and work directed toward the solution of fundamental public-health problems are emphasized. In biological and medical research, grants (currently primarily furnished for the development of universities and research institutions abroad) aid research in the biological sciences and in the chemical and physical sciences as they contribute to understanding of the living world. The foundation staff conducts research on the insect-borne viruses of importance to human health. The program in agriculture is directed toward long-range improvement of world food supplies, through support of basic research, training activities, and field research and demonstration programs conducted by the staff. In the social sciences, economics, political theory, international relations, sociology, and economic-development activities are emphasized. The humanities program supports work in intercultural studies, humanistic research, literature, and the arts. Under a fellowship program, chiefly for postdoctoral study, the foundation seeks to train personnel in its fields of interest. Headquarters are in New York, N.Y.

Rockefeller Institute for Medical Research, founded by John D. Rockefeller in 1901, in New York City, "to conduct, assist, and encourage investigations in the sciences and arts of hygiene, medicine and surgery, and to make knowledge relating to these various subjects available for the protection of the health of the public and the improved treatment of disease and injury." In 1954 the charter was amended so as to make the institute a part of the Univ. of the State of New York with authority to grant advanced degrees. Publications are *The Journal of Experimental Medicine*, *The Journal of General Physiology*, and *The Journal of Biophysical and Biochemical Cytology*. Reprints of publications are published as *Studies* and the results of conferences as *Monographs*.

Rocket (rōk'ēt), a propellant device that operates by the discharge of high-velocity gases which are generated completely within its body. The rocket travels in the direction opposite to the direction of discharge of the gases. It is capable of propelling aircraft, missiles, or spacecraft. Rockets operate in the vacuum of outer space as well as in the earth's atmosphere. See *Escape Velocity*; *Military and Naval Progress*; *Missile*; *Rocketry*.

Rocketry (rōk'ē-trī), the body of knowledge concerning the design, construction, and use of rockets (see *Rocket*). The basis of rocketry is a physical principle called *conservation of momentum*, which states that the vector sum of the product of the masses and velocities of a body or system of bodies is constant if no external forces act upon the system. In the case of a rocket, the mass of the expelled gases times their backward

ROCKETRY

velocity equals the mass of the rest of the rocket times its forward velocity. The higher the gas velocity, then, the faster a rocket will go with a given amount of fuel.

Originally, rockets were used in China—they were mentioned by Marco Polo. These were driven by gunpowder, also a Chinese invention, but were only for fireworks displays. Today they are called "skyrockets."

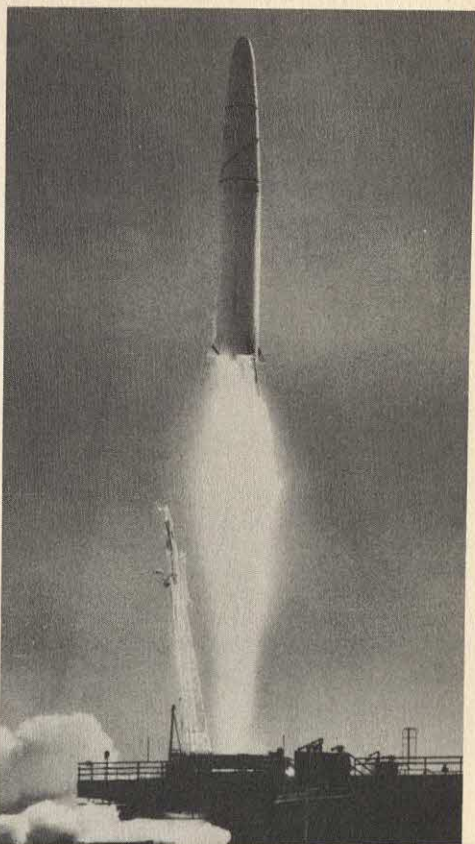
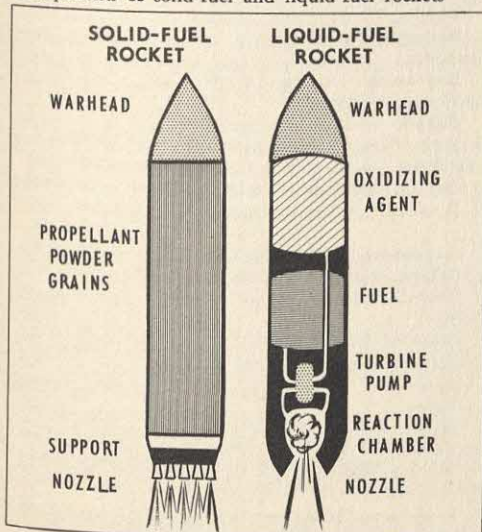
Modern rockets are powered by either solid or liquid fuels. Solid propellants contain the oxygen needed for the combustion of the fuel in the form of an appropriate chemical compound; some examples of solid propellants are gunpowder, cordite, and ballistite. Liquid-propelled rockets have their fuel in one tank and the oxidizing agent in another. The two are mixed in a reaction chamber, where they combine and discharge through a nozzle and thus provide thrust. Some liquid-propellant combinations are kerosene and liquid oxygen, aniline and nitric acid, and hydrazine and hydrogen peroxide.

When solid fuels are used, they may either be packed tightly in the rocket or else prepared in special shapes designed to promote uniform combustion. At present, liquid fuels are preferred for larger missiles because combustion may be precisely controlled, while with solid fuels there is no way of stopping or slowing down the reaction once started. However, solid fuels are easier and safer to handle, and improved solid-fuel rockets, such as the Navy Polaris, are coming into use.

Rockets with two or more stages are often used. These consist of a series of rockets, each mounted in the nose of a larger one. When the first rocket has been fired, its body shell (con-

ROCKET TYPES

Components of solid-fuel and liquid-fuel rockets



UPI Photo

IRBM BLAST-OFF

A Thor intermediate-range ballistic missile is launched in a successful test at Cape Canaveral, Fla.

taining the fuel tanks and engine) drops off. Then the next rocket fires, its efficiency being greater because it does not have to push the dead weight of the spent earlier stage. As many as four stages have been used successfully; a greater number presents too many opportunities for failure at present for it to be practical, but, in principle, the number of stages is unlimited.

Rockets can be steered during flight by moving vanes, which direct the expelled gases, or by firing auxiliary rockets at an angle to the main rocket, or by tilting the rocket engine as a whole with respect to the vehicle that the rocket is propelling.

Rockets in current production range from small 1- or 2-lb. weapons designed for infantry launching against tanks to gigantic intercontinental missiles weighing many tons and capable of carrying atomic or hydrogen warheads.

ROCKET AND MISSILE GLOSSARY

Absolute temperature. Graduated in Kelvin degrees above absolute zero.

Absolute zero. Minus 273 degrees C.

Acceleration. Rate of change of velocity, expressed in terms of per second per second.

Aerobee. A U.S. high-altitude research rocket.

Airlock. A system of airtight doors, such as those used in digging tunnels beneath rivers.

Air resistance. Resistance by the air to anything moving through it.

Angular velocity. The rate of change of the direction of a moving object.

Apogee. The position of any object in its orbit when it is farthest from the earth.

Artificial earth satellite. Object thrown into space from the earth in such fashion as to establish an orbit.

Aspect indicator. An instrument to establish the axis of a missile relative to its heading.

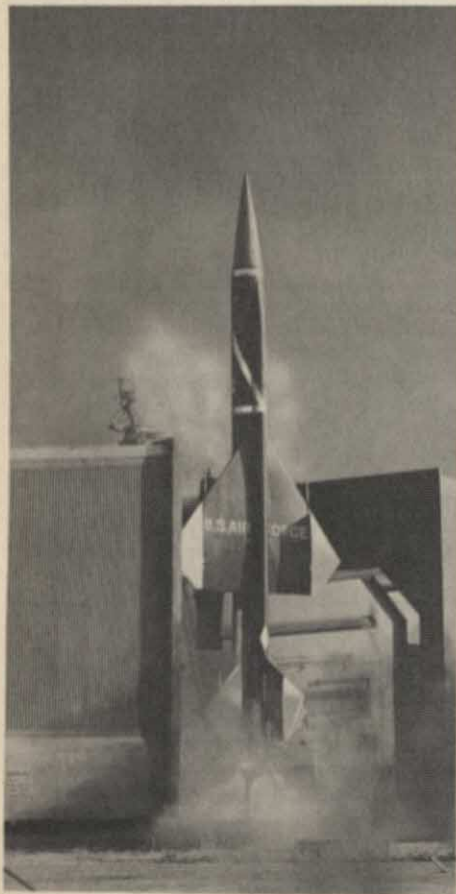
Astronautics. The science of traveling through space or of sending vehicles, manned and unmanned, through space.

Astrophysics. The science of physics as applied to astronomy.

Atlas. A U.S. intercontinental ballistic missile.

BOMARC GROUND-TO-AIR MISSILE

The 47-ft. missile is propelled at takeoff by a liquid-fuel rocket engine, later by two ramjet engines



Atmosphere. The gaseous envelope surrounding any heavenly body.

Atom. The smallest unit of a chemical element identifiable with the element.

Atomic energy. Of two kinds, fissionable and fusionable: Fissionable energy from the atom occurs when its heart is split; fusionable energy from it occurs when atomic particles join together.

Ballistics. The science of projectiles such as missiles.

Bolometer. A sensitive instrument to measure heat.

Bomarc. A U.S. surface-to-surface missile.

Booster. A propulsion unit to assist in a missile or aircraft take-off.

Breaking ellipses. Descriptive of "porpoising" behavior intended for man-made outer space vehicles to decelerate in re-entering the earth's atmosphere.

Characteristic velocity. In effect, the sum of all the velocities needed by a missile to escape the earth, decelerate to its objective, escape the objective and decelerate to earth.

Cloud chamber. A device to detect charged subatomic particles.

Coriolis force. The deflection imparted to a projectile due to the earth's rotation.

Corporal. A U.S. surface-to-surface missile.

Cosmic rays. Atomic nuclei from interstellar space that bombard the earth's atmosphere.

Count-down. The procedure of checking each system and subsystem preparatory to launching a rocket, using inverse numerical order.

Critical frequency. That at which radio waves are reflected back to earth from an ionized layer.

Critical temperature. That at which a gas cannot be liquefied.

Cryogenics. The science of low temperature conditions.

Cutoff receiver. A radio set that responds to a ground command to stop the flow of fuel in a missile.

Decay. Loss of energy in an orbiting satellite.

Deceleration. Slowing down.

Declination. Angular distance from the celestial equator.

Density. Mass-per-unit volume.

Destruct. To destroy a missile that has been launched.

Dog house. Housing outside a rocket that houses instruments (*slang*).

Doppler effect. The apparent change in the wave lengths of any wave-emitting object when the object and/or observer are in movement.

Dry weight. A missile without fuel.

DynaSoar. A boost-guide, orbital space craft.

Eccentricity. Degree of deviation from circular orbit.

Ecliptic. Plane of earth's orbit around sun.

Electrojet. Measurements of the earth's magnetic field.

Electromagnetic spectrum. The entire range of frequencies in electromagnetic radiation.

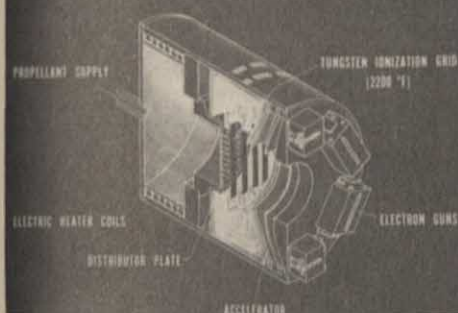
Emissivity. The ability of a surface to effect thermal radiation.

Escape velocity. The initial speed needed to overcome the pull of the gravity of any body.

Exhaust velocity. That at which propulsive gases leave a rocket.

Exosphere. The outermost fringe of the atmosphere.

MODEL OF ION ROCKET



MODEL OF AN ION ENGINE

A theoretical method of space-travel propulsion

Exotic fuel. One using chemicals having an exceptionally high rating, such as liquid oxygen.

Extragalactic nebulae. Systems in the universe outside our own galaxy.

Falcon. A U.S. air-to-air missile.

Fall-out. Descent of radioactive dust through the atmosphere.

Free fall. Behavior of objects or persons in the absence of gravity.

G. The gravitational force or pull of the earth.

Galactic absorption. Absorption of light by interstellar matter in a galaxy.

Galaxy. A group of several billion stars, star clusters, etc. Most recognizable is the earth's galaxy, the Milky Way.

Gamma ray. A high-energy photon.

Gantry. A special crane used in missile launchings.

Gimballed motor. A rocket motor mounted on a movable frame—to correct for pitching and yawing movements—used to steer a missile.

Gravity. The force which tends to draw all bodies in the earth's sphere toward the earth's center; the attraction between all particles of matter anywhere.

Guidance system. An automatic control system for the navigation of a missile or space system.

Half life. The amount of time required to reduce an element's radioactivity by half.

Heavieside layer. A region of the ionosphere.

High-temperature belt. A region of the earth's atmosphere at an altitude of about 35 m.

Hot. Radioactive (*slang*).

Hydrazine. An exotic fuel.

Hydrocarbon. A derivative of petroleum.

Hydrogen peroxide. A chemical used as an oxygen source in rockets.

Inertial guidance. An automatic navigation system using gyroscopic devices that absorb and interpret data on speed, position, etc., and adjust a missile (or space craft) to a predetermined flight path.

Infrared guidance. A system for reconnaissance of targets and navigation using infrared heat sources.

Intercontinental ballistic missile (ICBM). A long-range rocket weapon not subject to magnetic interference.

Interplanetary space. The region between planets.

Interstellar space. The region between stars in a galaxy.

Ion. An electrically charged atom or group of atoms.

Ion engine. A theoretical engine in which the thrust to propel a missile would be obtained from a stream of ionized atomic particles, generated by atomic fusion or fission or solar energy.

Ionosphere. The outer region of the atmosphere.

IRBM. Abbreviation for intermediate-range ballistic missile.

Jodrell Bank. Site of the world's largest radio telescope, in England.

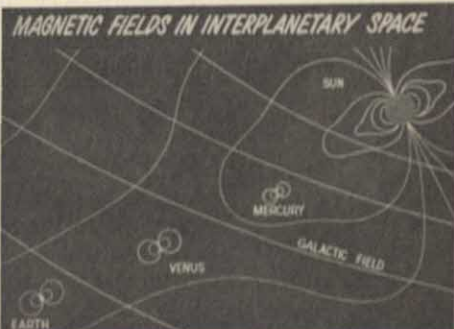
Kiloton. Measurement of nuclear (or A-bomb) energy, equal to a thousand tons of TNT.

Light year. Some 6,000,000,000,000 m., the distance that light can travel in one year; a unit of astronomical distance.

Liquid propellant. Rocket fuel using one or more liquids in a mixture (such as fuel, oxidizer, and an additive).

LOX. Liquid oxygen.

Magnetic storm. Fluctuations in the earth's magnetic field caused by solar flares.



MAGNETIC FIELDS IN SPACE

Magnetic storms disrupt communications

Magnetohydrodynamics. The study of the interaction between magnetic fields and electrical-conducting fluids and gases.

Matador. A U.S. subsonic and winged tactical missile.

Minitrack. Short for minitrack radio; the track of a miniature transmitting set emitting telemeter-type signals.

Missile. A weapon or object which is thrown or projected so as to strike a distant target.

Negatron. An "antiproton" that destroys matter with a consequent release of energy.

Nike. A U.S. surface-to-air interceptor missile.

Nose cone. The cone-shaped nose of a missile built to withstand friction occasioned by the high temperature of hypersonic speeds.

Orbital velocity. Speed of a body in closed or open orbit, most commonly applied to elliptical or near-circular orbits.

Oxidizer. A substance (generally LOX) that supplies oxygen to burn a fuel to produce heat and gas; in a rocket, oxygen for a propellant.

Parabolic velocity. Speed required to carry a body an infinite distance (equivalent to escape velocity).

Parsec. A unit of measure for interstellar space, equal to 3.26 light years.

Payload. The "useful" load of a rocket or space ship, such as persons and scientific instruments.

Perigee. The point in orbit of a missile or satellite closest to the earth.

Perihelion. That point nearest the sun in the orbit of any member of the solar system.

Period. Time required for an orbiting body to make a single revolution around its primary.

Perturbation. The effect of the gravitational attraction of one body on the orbit of another.

Photon. The unit of light or other electromagnetic radiation that measures out to one quantum of energy.

Photon engine. A type of rocket or missile engine in which the thrust is derived from harnessing a stream of light rays.

Pickup. A sensing unit that measures such variables as temperature, pressure, and velocity during flight.

Pitchover. Turning of a vertically rising vehicle into a course leading to a particular target.

Planet. A heavenly body, usually shining from reflected light, that orbits around the sun or other stars.

Plasma jet. A device for producing a stream of very hot or ionized gas.

Precession. The change that occurs in the position of the earth's axis of rotation in space due to the gravitational attraction of the sun and moon.

Primary. The body around which a satellite orbits.

Radial velocity. The speed of approach or departure of a body under observation.

Rascal. A U.S. air-to-surface missile.

Redstone. A U.S. surface-to-surface ballistic missile.

Re-entry. The return of a missile or space craft into the earth's atmosphere after having been rocketed above it.

Refraction. The bending of light rays in a transparent substance.

Regulus. A U.S. surface-to-surface winged missile.

Relaxation time. Period required for material to return to a normal state after stress or temperature change.

Revolution. Orbital motion around a primary.

Rotation. Rotary motion on an axis.

Sensible atmosphere. That offering resistance, that can be felt.

Sidereal. A measurement of time; a sidereal day is the time required for the earth to make a complete revolution as measured from the stars. It is four minutes shorter than our day, which is called a solar day.

Snark. A U.S. surface-to-surface winged strategic missile.

Solar engine. One designed to use the sun's heat as an energy source.

Space station. A manned artificial satellite.

Static firing. Testing a rocket motor on the ground.

Stratosphere. A stratum of the atmosphere lying immediately above the troposphere and immediately below the chemosphere; about 7 m. up, it extends 20 or more m.

Telemeter. To transmit data over great distances by means of electronic instruments.

Terrestrial space. That near the earth, close enough for the earth's influence to be dominant.

Tolerance. In radiation, the amount of radiation a person may absorb without harm.

Trajectory. The path taken by a missile.

Translunar. Beyond the moon.

Troposphere. The lower area of the earth's atmosphere.

Thrust. The propelling force exerted by a reaction engine.

Ultraviolet radiation. Emitted by heat sources on wave lengths shorter than those of light.

Umbilical cord. Any servicing or electrical line connecting a rocket or missile with ground units before launching time (*slang*).

Universal time. The same as Greenwich Mean Time.

WAC Corporal. A U.S. high-altitude research rocket.

Waste disposal. Getting rid of the "hot" ashes which are a by-product of a chain reaction.

Weightlessness. The absence of any gravitational pull on a person or object.

Rockford (*rŏk'fŏrd*), a city in north central Illinois, seat of Winnebago County, on the Rock River, ca. 90 m. n.w. of Chicago. It is on the Illinois Central and other railroads. It is primarily an industrial community, manufacturing machine tools, hardware, farm implements, automobile parts, precision machinery, and household appliances. Rockford is the center of a standard metropolitan statistical area (pop., 1960, 209,765) including all of Winnebago County. The city had a value added by manufacture of \$297,984,000 in 1958. The surrounding area is devoted to farming, chiefly grain, and dairying. The city is the seat of Rockford Coll. Camp Grant, an induction center in both World Wars, is 4 m. s. of the city and is used as the greater Rockford airport. Founded in 1834, Rockford was incorporated in 1852. The city is governed under the aldermanic system. Population, in 1950, 92,927; in 1960, 126,706.

Rock Gardening (*rŏk gŏr'den-ing*), the art of arranging plants in rocky areas or of creating artificial rocky areas decorated with plants which thrive in such localities. An otherwise unattractive or infertile area may thus be made into a flourishing garden. The art has been carried out with very charming results in areas where the soil is too sandy for ordinary gardening, e.g., on Cape Cod and at Pacific Grove, Calif. See also *Gardening*.

Rock Hill (*rŏk hĭl*), a city in South Carolina, 27 m. s. of Charlotte, N.C., situated on the Catawba River, and served by the Southern R.R. The manufactures include cotton textiles, hosiery, textile chemicals, truck bodies, and concrete products. The surrounding area is devoted to farming, chiefly fruit growing and turkey raising. Rock Hill is the seat of Winthrop Coll. About 28 m. away is the Kings Mountain National Military Park, which includes the site of a battle (1780) of the Revolutionary War. Founded in 1852, Rock Hill was incorporated as a city in 1892. Population, 1950, 24,502; in 1960, 29,404.

Rockingham Ware. See *Chinaware*.

Rocking Stones (*rŏk'ing stŏnz*), or LOGAN STONES, large stones that are poised so as to rock when pressure is applied. It is thought that this phenomenon is usually due to boulders having been deposited by the action of glaciers, but some rocking stones have been formed by the action of wind, water, and other natural causes. The most remarkable example of this class is the rocking stone of Tandil, in Argentina, about 200 m. s. of Buenos Aires. It weighs 700 tons and is so delicately poised as to rock in the wind.

Rock Island (*rŏk i'land*), county seat of Rock Island County, Illinois, 180 m. s.w. of Chicago, located at the junction of the Mississippi and Rock Rivers at the point where the Hennepin Canal reaches the Mississippi. It is served by the Chicago, Rock Island & Pacific, the Chicago, Milwaukee, St. Paul & Pacific, the Chicago, Burlington & Quincy, and other railroads. Two bridges connect Rock Island with the Iowa shore of the Mississippi. The island houses the army's Rock Island Arsenal. Manufactures include farm implements, millwork, rubber footwear, paper boxes, automotive equipment, electrical supplies, machinery, and ironware. Rock Island is the seat of Augustana Coll. Blackhawk State Park, once an Indian playground, is now a recreation center. The place was settled in 1828 as Stephenson and received its present name in 1841. Population, 1940, 42,775; in 1950, 48,710.

Rockland (*rŏk'land*), county seat of Knox County, Maine, on Penobscot Bay, 85 m. n.e. of Portland. It is on the Maine Central R.R. and has a fine harbor. It is the center of the Penobscot Bay resort area, with its yachting, motorboating, and deep-sea fishing. Manufactures include boots and shoes, clothing, boilers, canned fish, lime, and machinery. The surrounding country is fertile and contains large granite and limestone quarries. In 1630 the first settlement was made in the vicinity. First known as East Thomaston, the name was changed to Rockland in 1850. It was incorporated in 1854. Population, 1930, 9,075; in 1950, 9,234.

Rockland, a town in Plymouth County, Massachusetts, 16 m. s.e. of Boston. It is on the New York, New Haven & Hartford R.R. and is a commercial and manufacturing center. It has several fine schools and churches. The manufactures include boots and shoes and allied products, including welts and dyes. Originally it was a part of Abington, but was incorporated as a separate town in 1874. Population, 1950, 8,960.

Rockne (*rŏk'nē*), KNUTE KENNETH, football coach, born in Voso, Norway, in March 1888; died Mar. 31, 1931. He came to the U.S. in 1893, and later studied at Notre Dame Univ., from which he was graduated in 1914. He remained

at Notre Dame as an instructor in chemistry and as assistant football coach. By 1918 he was head coach and retained that position until his death in an airplane accident in 1931. Known as America's greatest football coach, Rockne was famous for his emphasis on sportsmanship and character as well as for his ingenuity in football strategy. The story of his life was produced in 1940 as the movie, "Knute Rockne—All-American."

Rock River (*rŏk riu'ēr*), a stream that rises in Wisconsin, flows through Illinois, and joins the Mississippi immediately south of Rock Island. It has a course of 375 m. and flows through a rich farming country. Among the cities on its banks are Janesville, Beloit, Rockford, Sterling, and Rock Island.

Rocks (*rŏks*). See *Geology*.

Rock Springs (*rŏk sprinz*), a city in Sweetwater County, Wyoming, 252 m. w. of Laramie. It is on Bitter Creek and on the Union Pacific R.R. and is surrounded by extensive coal-mining districts. It trades in coal and lumber. The seat of the Wyoming State Hospital, it was first settled about 1862. Population, 1950, 10,857.

Rockwell (*rŏk'wēl*), NORMAN, artist, born Feb. 3, 1894, in New York City. Before having completed high school, he became a student at the Art Students' League in New York City, and was almost immediately successful in selling his paintings to magazines. He is best known for his covers for the *Saturday Evening Post*, and his widely distributed illustrations of the Four Freedoms. Believing that every picture should tell a story, he draws his illustrations with careful realism and minute detail.

Rocky Mount (*rŏk'i mount*), a city located in both Edgecomb and Nash Counties, North Carolina, about 47 m. n.e. of Raleigh. In a tobacco, cotton, and peanut-producing region, it has manufactures of these products, as well as of textiles and wood products. It was founded in 1867 and incorporated as a city in 1907. Population, 1940, 25,568; in 1950, 27,697.

Rocky Mountain Goat (*mount'in gŏt*), a ruminant quadruped native to the Rocky Mts., ranging from Colorado to the Arctic Circle. It is a beautiful animal, covered with long white hair, and its skin is valued in the market. The flesh is tender and nutritious. Its size is about that of the domestic goat, but the limbs are stronger and the body is heavier. The mane is erect, the horns are slightly curved, and the beard on the throat is quite like that of a goat, but it is a much finer-looking animal. The *Rocky Mountain sheep*, or *bighorn*, is an allied animal. It has shorter hair and immense horns.

Rocky Mountains (*mount'inz*), an extensive mountain system, including the most elevated peaks of North America. The name is sometimes applied to the entire mountain region in the

western part of the U.S., but it belongs more particularly to the eastern system of the Cordilleras of North America, extending from the southern part of New Mexico to the Arctic Ocean, terminating near the northeastern corner of Alaska. This portion of the western highlands extends from New Mexico in a northwesterly direction, has a length of about 4,000 m., and encloses several very arid and elevated plateaus. It is widest at about the latitude of 40° and the trend is nearly parallel to the Pacific coast.

The principal ranges in New Mexico are the San Andres, Manzano, Gallinas, and Taos mountains. Castilla Peak, in the last named range, is one of the highest elevations, being 12,615 ft. above sea level. In Colorado many complicated ranges extend nearly parallel to each other, the most elevated peaks being Pike's Peak, 14,150 ft.; Gray's Peak, 14,345 ft.; Long's Peak, 14,275 ft.; and Mount of the Holy Cross, 14,176 ft. The Laramie, Big Horn, and Shoshone Mts. are among the ranges of Wyoming; Fremont Peak, in the Wind River Range, is one of the most elevated peaks in Wyoming, being 13,570 ft. The Wasatch Mts. trend in many parallel ranges through Utah, and in the northern region of that state is an extensive lake system, including Great Salt Lake. The principal ranges include Gilbert Peak, 13,690 ft.; Mt. Hilgard, 11,460 ft.; Mt. Terrill, 11,600 ft.; and Wheeler Peak, 12,075 ft. The lofty ranges of the Bitter Root Mts. form part of the boundary between Montana and Idaho, with connected ranges in each state and in Washington, whence the Rocky Mt. system passes into Canada.

BEARTOOTH RANGE OF THE ROCKY MOUNTAINS

Courtesy Northern Pacific Railway



In Canada it forms the boundary between Alberta and British Columbia, whence the principal ranges pass through the upper part of the latter and thence northwesterly through Yukon, with ranges trending westward into Alaska. The most elevated peaks of Canada include Mt. Brown, 16,000 ft.; Mt. Hooker, 15,700 ft.; Mt. Logan, 19,514 ft.; and Mt. St. Elias, 18,010 ft. The last two named are near the Alaska boundary and some distance northwest in Alaska is Mt. Wrangel, 19,400 ft. high. In 1901 the U.S. geological survey reported that Mt. McKinley, height 20,464 ft., is the highest peak in territory belonging to the U.S. It is situated about 200 m. N.W. of Mt. Wrangel, which was formerly considered the highest peak in Alaska.

The Rocky Mts. are rich in minerals, which include gold, silver, copper, iron, granite, coal, petroleum, and many others, and the region possesses some of the most extensive and productive mines in the world. The building of railroads in practically all parts of this mountain region has caused the rise of great cities, while settlers have been attracted there to establish productive vineyards, orchards, and farms. In many regions stock-raising is a vast industry. Some portions are noted for their scenery, particularly the Yellowstone National Park in Montana, Wyoming, and Idaho, and the Rocky Mt. Park, near Banff, Alberta. The Missouri, Columbia, Colorado, Rio Grande, Arkansas, Mackenzie, Saskatchewan, Yukon, and other great rivers of North America have their source in the Rocky Mts.

Rocky Mountain Spotted Fever, or TICK FEVER, an acute infectious disease transmitted to man by ticks (*q.v.*). The causative organism is a type of Rickettsiae, microscopic organisms. Four to eight days after a bite by an infected tick there is usually a sudden onset of severe symptoms of chills, acute pain in the muscles and joints, with headache, high fever, etc. The condition is marked by nervousness, often with delirium and coma in severe or fatal cases. There is a characteristic rose-colored generalized skin rash of variable-sized spots which become purple and often hemorrhagic. The occurrence of this rash on the palms and soles is of diagnostic importance. A blood test called the *Weil-Felix reaction* is used for positive diagnosis in uncertain cases. Treatment is symptomatic and supportive. Prophylactic measures include avoidance of and searching of the skin for ticks, destroying small animal hosts, dipping of infested livestock, and special vaccination of people in endemic areas.

Rococo (*rô-kô'kô*), in art, the style prevalent in France at the time of Louis XV and—with certain modifications—simultaneously in Germany, Austria, and elsewhere in Europe. A sub-



ROCOCO. BOW PORCELAIN GROUP, ca. 1760

division of the Baroque style (*q.v.*), it is characterized by particular richness of ornamentation and curved lines. In contrast to the previous period of the Baroque, Rococo decoration is loose and light.

Rodentia (*rô-dên'shî-à*), OF RODENTS, an order of mammals characterized by incisors shaped so that they can gnaw with ease the hard vegetable substances upon which they principally feed, such as nuts, grains, and the bark of trees. The *rodents*, as they are frequently called, include about 20 families and several thousand species, among which are the mice, rats, squirrels, beavers, agoutis, and lemmings. Most species are furred, but some, such as the porcupine, have spines. Some are aquatic, as the muskrat, and some live largely in trees, as several species of squirrels, but the greater number live upon or burrow in the ground. While many are injurious to agriculture or obnoxious pests to dwellings, many are valuable for the fur they bear. In these animals the brain is small, especially in those that feed strictly on herbs, but most of the species are characterized by great vigor and activity. Many fossil remains of rodents are found from the earliest Tertiary epoch, including many species that differ from the animals now in existence.

Rodeo (*rô-dê-ô*), originally a place where cattle were collected; it has now come to mean a special exhibition where cowboys gather to show their skills. Special events such as lasso (rope) spinning and cattle roping are combined with "bronco busting," the art of riding untamed horses. Probably the outstanding rodeo in the U.S. is the one held annually at Cheyenne, Wyo.

Rodgers (*rôj'êrz*), JOHN, naval officer, born

RODMAN

in Hartford County, Maryland, Aug. 8, 1812; died in Washington, D.C., May 12, 1882. He was a son of Capt. John Rodgers (1771-1838), who fired the first shot of the War of 1812. In 1828 he entered the navy and in 1853 was given command of the steamer *John Hancock*, then sent on an exploring expedition to the North Pacific. He commanded the monitor *Weechawken* in 1863, when the vessel captured the Confederate ironclad *Atlanta*, and was made commodore for his services. In 1869 he was given command of the China fleet as rear admiral and two years later captured several forts in Korea, thus ending the outrages perpetrated on American commerce off the Korean shore. He served as commander of the Mare Island navy yard at San Francisco from 1873 to 1877, and in the latter year became superintendent of the U.S. Naval Observatory at Washington, a position he held until his death.

Rodgers, RICHARD, composer, born in New York, N.Y., June 28, 1902. He met Lorenz Hart in 1919 while at Columbia Coll. and left school that year to study with Walter Damrosch (*q.v.*) at the Inst. of Musical Art. A short time later he and Hart (as lyricist) began their long collaboration. They produced such musical plays as "Garrick Gaieties" (1925), "On Your Toes" (1936), "Babes in Arms" (1937), and "I Married an Angel" (1938). In 1943 Rodgers worked with Oscar Hammerstein II (*q.v.*) on "Oklahoma!". It won a special Pulitzer prize (1944) and had one of the longest runs of any musical. Hart died in 1943, and Rodgers began to work regularly with Hammerstein. Some of their musicals were "Carousel" (1945), "South Pacific" (1949; New York Drama Critics Circle award, 1949; Pulitzer drama award, 1950), "The King and I" (1951; Antoinette Perry award, 1952), "Flower Drum Song" (1958), and "The Sound of Music" (1959). Hammerstein died in 1960, but Rodgers continued to compose, most recently for the musical "No Strings" (1962).

Rodin (*rô-dân'*), (FRANÇOIS) AUGUSTE (RENÉ), sculptor, born in Paris, France, Nov. 12, 1840; died in Meudon, Nov. 17, 1917. At an early age he began to copy antique sculptures and, at 17, he studied with Antoine L. Barye (*q.v.*) and later (1864-71) with Albert E. Carrier-Belleuse. After traveling in Italy and Germany (1875), he exhibited the naturalistic sculpture "The Age of Bronze" in the Paris Salon of 1877, where it aroused stormy criticism. His reputation was established with his second major work, "St. John the Baptist Preaching" (1878-80).

In 1880 he received his first public commission—the bronze portal for the Musée des Arts Décoratifs in Paris, "The Gate of Hell," which was never completed, although it occupied him for over 20 years. A part of this gigantic composition, "The Thinker," became what is probably his

best-known work. In 1884 he won a competition held by the town of Calais for a monument to Eustache de St-Pierre, a 14th-century hero of Calais. Instead of conceiving a single figure, Rodin sculptured St-Pierre with his companions, in "The Burghers of Calais," unveiled in 1895. Even by 1898 his work was still controversial. That year the Société des Gens de Lettres refused his tremendous figure of Balzac (8.11 ft.). It was finally erected in Paris in 1939.

In the course of his work, Rodin aimed at an absolute interpretation of nature. Bronze and marble were his chief media, in which he created such famous works as "The Kiss" (marble, 1886) and "The Hand of God" (marble, 1897-98). All his portrait busts (e.g., Victor Hugo, 1897; Georges Clemenceau, 1911; Pope Benedict XV, 1915) show intense and powerful expressiveness, and his drawings reveal his mastery of human anatomy and his economy and discipline in design. For an example of his work, see *Sculpture*.

Rodney (rôd'nî), CAESAR, statesman, born in Dover, Del., Oct. 7, 1728; died there, June 26, 1784. He received his education at home and entered public life in 1755, as high sheriff of Kent County, Delaware. He later held various civil, judicial, and legislative posts in Delaware. Rodney was a representative from Delaware to the Stamp Congress (1765) and to the Continental Congress (1774-75) and a signer of the Declaration of Independence. He served in the Revolutionary War and in 1778 was elected president of Delaware for a three-year term.

Rodzinski (rô-jîn'skî), ARTUR, orchestra conductor, born in Split, Austria (now Yugoslavia), Jan. 2, 1894; died in Boston, Mass., Nov. 27, 1958. After getting a law degree at the Univ. of Vienna and studying music at the Vienna Acad. of Music, he was conductor of opera and of the Philharmonic Orchestra in Warsaw, Poland. He came to the U.S. in 1926 and was assistant conductor (1926-29) of the Philadelphia Orchestra under Leopold Stokowski. He conducted the Los Angeles Philharmonic Orchestra (1929-33), the Cleveland Symphony Orchestra (1933-42), and the New York Philharmonic-Symphony Orchestra (1943-47) and directed the Chicago Symphony Orchestra (1947-48). He was one of the first conductors of an American orchestra to conduct (1936-37) at the Salzburg (Austria) Music Festival. After 1948 he was a guest conductor of orchestras in the U.S., Europe, and South America; he conducted (1953) the *première* of Prokofiev's opera "War and Peace" in Florence, Italy.

Roe (rô), EDWARD PAYSON, clergyman, novelist, born in New Windsor, N.Y., March 7, 1838; died in Cornwall, N.Y., July 19, 1888. He studied at Williams Coll. and at the Auburn Theological Sem. He served as a chaplain in the Union army (1862-65) and afterward for eight years as pastor

of a Presbyterian church in Highland Falls, N.Y. In 1871 he visited the scene of the Chicago fire and subsequently wrote his first book, "Barriers Burned Away" (1872), a novel based on that event. It was an immediate success and was followed (1874) by a second novel, "Opening a Chestnut Burr." This added success caused him to resign his ministry, and he thereafter devoted himself to writing. His many novels and nature studies, all highly moralistic, include "From Jest to Earnest" (1875) and "Nature's Serial Story" (1885).

Roebeling (rôb'ling), WASHINGTON AUGUSTUS, civil engineer, born in Saxonburg, Pa., May 26, 1837; died in Trenton, N.J., July 21, 1926. His father, JOHN A. ROEBLING (1806-69), a German-American engineer, demonstrated the practicability of steel cable and pioneered in the building of suspension bridges (e.g., the Niagara Falls Bridge). The son was graduated from Rensselaer Polytechnic Inst. in Troy, N.Y., in 1857. After the Civil War, during which he served with the Union army as an engineer, he studied engineering in Europe and later worked with his father on the construction of a suspension bridge across the Ohio River at Cincinnati. In 1869 he was placed in charge of the construction of the Brooklyn Bridge, which his father had begun just before his death, caused by an injury while working on the bridge. The younger Roebeling fell ill (1872) of caisson disease, but, in spite of the resulting invalidism, he directed the completion (1883) of the project from his home. In 1888 he retired from professional engineering, but he later supervised (1920) the construction of the Bear Mountain Bridge over the Hudson River, N.Y. See also *Bridges*.

Roebuck (rô'biuk), OF ROE DEER, a small species of deer of Europe and Asia, found in wooded mountainous areas. Full-grown, it measures only 26 to 34 in. at the shoulder and weighs about 60 lb. It has short antlers and a stubby tail. Its color is brownish-yellow in summer, but a duller brown in winter, and features a large white rump patch. There are also Siberian and Manchurian varieties, both about the same size as the European species.

Roentgen (rânt'gen), OF RÖNTGEN, WILHELM KONRAD, physicist, born in Lennep, Germany, March 27, 1845; died in Munich, Feb. 10, 1923. He was graduated from Zurich (Switzerland) Univ. in 1870, but when his favorite professor, August Kundt, moved to Würzburg, he followed him to that city. In 1874 Roentgen moved to Strasbourg, where he was made assistant professor; thereafter he was professor of physics at a number of German universities. In 1900 he went to the Univ. of Munich, where he remained for 20 years. In 1895, while he was director of the Physical Inst. of the Univ. of Würzburg, Roentgen announced the discovery of a type of ray

capable of passing through various substances opaque to ordinary light. Since he did not fully understand the nature of the specific rays, he called them X-rays (X standing for unknown); but they were later also called Roentgen rays in his honor. In 1901 he was the first recipient of the Nobel Prize for physics for this discovery (see *X-rays*). Roentgen also conducted research in other fields of physics, notably in the conduction of electricity through gases and of heat through crystals and in the electrical and magnetic properties of light.

Roerich (*rd'rik*), NICHOLAS KONSTANTIN, painter, stage designer, and archaeologist, born in St. Petersburg (now Leningrad), Russia, Sept. 27, 1874; died in Kulu, India, Dec. 13, 1947. After his studies at the Univ. of St. Petersburg, he turned to art. He painted a fresco for the Kazan railway station in Moscow and then did some stage designs. In 1921 he came to the U.S. and later established the Roerich Gallery in New York City, in which many of his paintings are displayed. In 1929 he proposed the Roerich Pact and Banner of Peace, a treaty accepted by 22 American countries for the protection of cultural treasures in time of war. After 1930 Roerich undertook archaeological expeditions to India, Tibet, and China, eventually taking up residence in Kulu, Punjab, India. He wrote numerous books, including "Himalayas: The Abode of Light" (1947).

Rogation Days (*rd-gā'shūn dāz*), days observed in certain Western churches with litanies, processions, and prayer. In the Roman Catholic Church the days fall on April 25 (called Major) and on the three days immediately preceding Ascension Day (called Minor). Rogation days are observed to invoke God's mercy, to ask protection from calamities, and to obtain a bountiful harvest. In the Episcopal Church, the days, designated days of Solemn Supplication, are the three days preceding Ascension Day and following the 5th Sunday (Rogation Sunday) after Easter.

Roger I (*rd-zhā'*), also ROGER GUISCARD, ruler of Sicily, probably born in Normandy in 1031; died in Mileto, Sicily, June 22, 1101. He was the youngest son of Tancred of Hauteville, and brother of Robert Guiscard (*q.v.*). In 1060 the brothers began the conquest of the island of Sicily, then inhabited by Moslems and subject to Arab princes. In 1072 Palermo, the capital, fell, but the conquest was not completed until 1091. As suzerain, Robert invested Roger as count of Sicily in 1072, and with Robert's death (1085) Roger became the supreme Norman lord in southern Italy. In that position, he became master of the insular church, and in 1098 the papacy granted to him and his heirs the apostolic legateship in the island. Although he ruled a feudal state, he became known for his tolerance. He was succeeded by his son ROGER II (1095-1154),

who became first king of Sicily in 1130 and brought the Norman conquests under a single rule.

Rogers (*rōj'ērz*), BRUCE, book and type designer, born in Lafayette, Ind., May 14, 1870; died in New Fairfield, Conn., May 18, 1957. He was graduated from Purdue Univ. in 1890, worked (1891-92) on the art staff of the Indianapolis *News*, and was (1893-1917) a designer for several book publishers. He was later, successively, printing adviser to the Cambridge and Harvard university presses and, throughout his career, prepared the layout for numerous fine editions. He also designed the type face called Centaur. The American Acad. of Arts awarded him its Gold Medal in 1948; Rogers was the first in his profession to receive this honor.

Rogers, EDITH (*nee* NOURSE), Congresswoman, born in 1881 in Saco, Me. She was educated at Rogers Hall School, Lowell, Mass., and in Paris. After World War I she spent four years as an American Red Cross worker at Walter Reed Hospital caring for disabled soldiers; her work became so well known that President Harding, in 1922, appointed her his personal representative in charge of the care of disabled servicemen. She was reappointed by Presidents Coolidge and Hoover in 1923 and 1929 respectively. When her husband, John Jacob Rogers, a member of the House of Representatives from Massachusetts, died in 1925, she won a special election to finish his term and thereafter won subsequent elections to the House on the Republican ticket.

Rogers, JAMES GAMBLE, architect, born in Bryants Station, Ky., March 3, 1867; died in New York, N.Y., Oct. 1, 1947. He was educated at Yale, Columbia, and Northwestern universities and began his architectural practice in New York City in 1905. His many buildings include the Sterling Memorial Library, the Sterling Law School, the Harkness Memorial Quadrangle, and many other buildings at Yale Univ.; Butler Library, at Columbia Univ.; the Columbia Presbyterian Medical Center, in New York City (for illustration, see *Medical Center*); and a group of professional buildings of Northwestern Univ., in Chicago, Ill.

Rogers, JOHN, clergyman, born in Aston, England, ca. 1500; died in Smithfield, Feb. 4, 1555. He was graduated from Pembroke Hall, Cambridge, in 1526. As a Roman Catholic priest, he went to Antwerp (1534), where he met William Tyndale (*q.v.*). Under Tyndale's influence, he accepted Protestant beliefs, and under the pseudonym of Thomas Matthew he brought out (1537) an English version of the Bible, building his rendition upon the translations of Tyndale and Myles Coverdale (*q.v.*). Rogers returned to England in 1548. Arrested as a heretic and for denying the presence of Christ in the Mass, he was tried, convicted, and burned at the stake.

Rogers, JOHN, sculptor, born in Salem, Mass., Oct. 30, 1829; died in New Canaan, Conn., July 26, 1904. He was educated in Boston public schools and then worked at various jobs until he began modeling small statuette groups. In 1858 he went to Rome and Paris to study art. Discouraged, he returned to the U.S. and obtained employment as a draftsman in Chicago. About 1860 the popular success of his "The Checkers Players" encouraged him to resume sculptural work. He confined his work almost completely to small groups of figures, known as Rogers Groups, and used many incidents concerned with the Civil War as his subject matter. Among his smaller pieces are "The Slave Auction" and "The Council of War"; he also executed an equestrian statue of Gen. Reynolds in Philadelphia, Pa., and a seated Lincoln in Manchester, N.H.

Rogers, RANDOLPH, sculptor, born in Waterloo, N.Y., July 6, 1825; died in Rome, Italy, Jan. 15, 1892. After attending public schools, he engaged in business, but in 1848 he went to Rome, Italy, to study sculpture. He came back to the U.S. in 1853 and worked in New York City until 1855, when he returned to Italy. His works are well known and include "Nydia," a statue of John Adams for Mt. Auburn Cemetery, the "Columbus" doors of the Capitol at Washington (cast, 1858), a statue of Lincoln in Philadelphia, Pa., and the "Genius of Connecticut" on the dome of the state capitol at Hartford.

Rogers, ROBERT, frontiersman, born in Methuen, Mass., Nov. 7, 1731; died in London, England, May 18, 1795. Early in his life, his family moved to New Hampshire, where he became a frontiersman. During the fourth and last of the French and Indian Wars (*q.v.*), he was a commander of British scouting units, playing a heroic part in several battles. In 1760 he was sent west to accept the surrender of the French posts on the Great Lakes, and in 1763 he participated in crushing the rebellion of the Indian chief Pontiac (*q.v.*). He was disgraced, however, for illicit trade with the Indians and went to England in 1765. While there, he published (1765) his "Journals" and "A Concise Account of North America," followed by a crude play, "Ponteach: or the Savages of America" (1766). Rogers returned to America in 1766 and, in 1768, was charged with treasonable dealings with the French, but was acquitted. He went to England again in 1769 but returned to America in 1775. Imprisoned as a British spy in 1776, Rogers escaped and fought with the British until he fled, in 1780, to England, where he died in poverty 15 years later.

Rogers, SAMUEL, poet, born in London, England, July 30, 1763; died there, Sept. 18, 1855. He was the son of a London banker, and he entered his father's business. Poor health, how-

ever, forced him to seek prolonged vacations, during which he developed his literary interests. Rogers became well known as a conversationalist and a patron and friend of many writers and poets. He declined the laureateship in 1850 because of his advanced years but recommended Lord Tennyson (*q.v.*) in his place. Rogers' works include "An Ode to Superstition" (1786), "The Pleasures of Memory" (1792), and "Human Life" (1819).

Rogers, WILL, humorist, actor, writer, born WILLIAM PENN ADAIR ROGERS in Oologah, Indian Territory (now Oklahoma), Nov. 4, 1879; killed in an airplane crash, with Wiley Post (*q.v.*), near Point Barrow, Alaska, Aug. 15, 1935. He entered vaudeville in New York City in 1905, and (beginning in 1914) he was associated with the "Ziegfeld Follies" for many years, except when he played in motion pictures (*e.g.*, "State Fair," "Life Begins at Forty"). Through a newspaper column in the New York *Times* (1922-35), a radio program called "Gulf Headlines," and many books, he gained a national reputation as the "cowboy philosopher" for his humorous comments on politics and world events. His books include "The Cowboy Philosopher on the Peace Conference" (1919), "The Cowboy Philosopher on Prohibition" (1919), "What We Laugh At" (1920), "The Illiterate Digest" (1924), and "Will Rogers' Political Follies" (1929).

Rogers, WILLIAM PIERCE, cabinet member, born in Norfolk, N.Y., June 23, 1913. Educated at Colgate Univ., he received a law degree from Cornell Univ. in 1937. He was an assistant district attorney of New York County (1938-42, 1946-47), a counsel for two Senate investigating committees (1947-50), and Deputy U.S. Attorney General (1953-57). Rogers was U.S. Attorney General in 1958-61, resigning to take up the private practice of law.

Rogers, WOODS, English navigator and colonial governor, died in 1732. From 1708 to 1711 he commanded a privateering expedition against the Spanish in the South Seas, reaching the Juan Fernández Islands in 1709, where he rescued Alexander Selkirk (*q.v.*). He published a journal of his expedition, "A Cruising Voyage round the World," in 1712. In 1717 Rogers leased the Bahama Islands from the lords proprietors and was twice commissioned as governor (1718-21, 1729-32). During his administration, he suppressed piracy, repelled a Spanish invasion, and established a house of assembly.

Roget (rō-zhā), PETER MARK, physician, born in London, England, in 1779; died in 1869. Educated at the Univ. of Edinburgh, he practiced medicine in London and Manchester. He is best known for his "Thesaurus of English Words and Phrases" (1852), which ran through 28 editions during his lifetime and has remained a

standard reference work published in English.

Rohlf (*rōlf*), ANNA KATHARINE GREEN, novelist, born in Brooklyn, N.Y., Nov. 11, 1846; died in Buffalo, N.Y., April 11, 1935. Graduated from Ripley Female Coll., Poultney, Vt., she became a popular novelist. In 1884, she married Charles Rohlf, but continued writing under her maiden name. Her first book to attract wide attention was "The Leavenworth Case" (1878), a detective story, which was dramatized in 1892. She had a considerable influence on the development of the detective novel in the U.S. Other writings include "The Lost Man's Lane," "The Millionaire Baby," and "The Filigree Ball."

Rohlf, FRIEDRICH GERHARD, German traveler, born in Vegesack, Germany, April 14, 1831; died in Godesberg, June 3, 1896. After being graduated from Berlin Univ. medical school, he joined the French army in Algeria as surgeon. He made tours through North Africa (1863-65), and joined the English expedition against Abyssinia, traveled in Cyrenaica (1868), made an expedition into the Libyan Desert and other parts of Africa and wrote several travel books.

Roi Soleil (*rwā sō-lā'*), a French expression meaning "sun king," and used in reference to King Louis XIV (*q.v.*), who made the radiating sun his emblem.

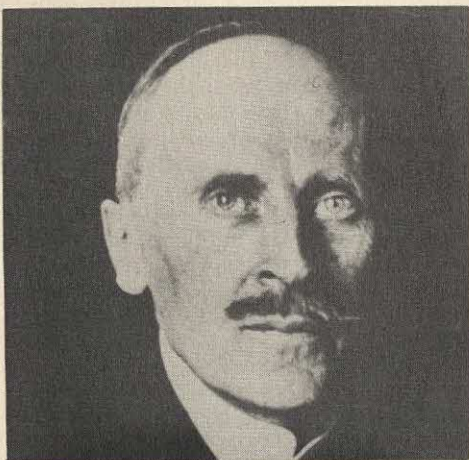
Rokossovsky (*rū-kū-sōf'skī*), KONSTANTIN K., army officer, born in Warsaw, Poland, Dec. 25, 1896. He served in the czarist army in World War I and then joined (1917) the Red Army, in which he rose to prominence. But in 1937 he was sent to Siberia as a suspected political deviationist and spent several years there. Recalled after the German invasion (1941) of Russia, he played a leading part in the defense of Smolensk and Moscow and the offensives at Stalingrad and Warsaw. He was elected (1946) to the supreme soviet but became Polish minister of defense (1949) and a vice premier of Poland (1952). Ousted from these posts in 1956, he returned to the U.S.S.R., where he was appointed commander of the Trans-Caucasian Military District in 1957 and became a deputy defense minister in 1958.

Roland (*rō'land*), in Italian *Orlando*, the most famous hero in the legends around Charlemagne (*q.v.*), based, however, on history. Although only one line in Einhard's "*Vita Caroli Magni*" hints at him, as prefect of Brittany who, on the retreat to France from Spain in 778, with Charlemagne's men, died in the valley of Roncesvalles (or Roncevaux) in the Pyrenees, in the onslaught of the Gascons, he became the hero of the "*Chanson de Roland*," the national epic of France. According to the legend, he was the nephew of Charlemagne, and is depicted as the ideal of a Christian knight. He is also the hero of a 12th-century German epic.

Rolfe (*rōlf*), JOHN, colonist, born in Norfolk, England, in 1585; died in Virginia (presumably massacred by Indians) in 1622. He left England with a company of colonists in 1609, but was shipwrecked in the Bermuda Islands and did not reach Virginia until 1610. His wife, whom he had married in England in 1608, died shortly after their arrival in Virginia, and in 1614 he married Pocahontas (*q.v.*). Rolfe improved the cultivation of tobacco, and so may be said to have had a major part in shaping the economic and social future of Virginia. In 1616, the Rolfe made a trip to England, where Pocahontas died. On his return to America he became prominent in the government of Virginia.

Rolfe, WILLIAM JAMES, teacher and author, born in Newburyport, Mass., Dec. 10, 1827; died in Cambridge, Mass., July 7, 1910. He was educated at Amherst Coll., and became a school-teacher in Cambridge, Mass. He served as co-editor of the *Popular Science News* (1869-93), but after retiring from teaching in 1869 devoted most of his time to writing textbooks and editing the poetical works of Tennyson, Scott, and others. His editions of the plays of Shakespeare remained standard school texts for many years.

Rolland (*rō-lān'*), ROMAIN, born in Clamecy, France, Jan. 29, 1866; died in Vézelay, France, Dec. 30, 1944. He was educated in his native city and in Paris. From 1889 to 1891 he was a member of the French school of history and archeology in Rome. In 1891, he returned to France, acquired his doctorate with a thesis on "The Origins of the Opera in Europe: Before Lully and Scarlatti" (1895), and then taught art history and music. After 1900, he published serially his best-known work "Jean-Christophe," the story of a German musician, "The Lives of Illustrious Men" (Beethoven, Michelangelo, Tolstoy), and his books on Handel and "Musicians of the Past." During World War I he devoted himself, in Switzerland, to the International Red Cross. At this time his article, "Above the Conflict," aroused the indignation of all the belligerents. In 1917, on the recommendation of Anatole France, he won the Nobel Prize for literature "as a tribute to the lofty idealism of his writings, and to the wide understanding of human nature springing from a profound sympathy which they reveal." After a short stay in Paris, he lived again in Switzerland (1922-38). He wrote several books on Mahatma Gandhi and Vivakananda, for the better understanding of Asia by Europeans; a cycle of novels, "The Soul Enchanted" (1925-34); "The Great Creative Epochs," dealing with Beethoven; and, finally, a cycle of plays on the French Revolution which he had begun as early as 1900. In 1938, he returned to France. For him, freedom and dignity for the individual were the most



Courtesy French Press & Information Service, N. Y.

ROMAIN ROLLAND

important aims to be achieved, and he fought for them in his writings and in his actions throughout his entire life.

Roller Bearings (*rôl'ēr bār'ingz*). See *Ball and Roller Bearings*.

Rolling Mill (*rôl'ing mîl*), an establishment in which metal is made into desired forms by being worked between pairs of rolls. Steel and other metals in the form of ingots, as a result of the refining process, are a relatively weak mass of nonuniform crystals or grains. The rolling pressure squeezes and elongates these crystals, increasing the strength of the hot-rolled product. Ingots are first rolled into semifinished forms called blooms, billets, or slabs on rolling mills consisting of two or three power-driven steel rolls. On a two-high mill, the rolls always rotate in opposite directions to each other. They grip the metal between themselves, reducing its thickness and lengthening it proportionately. Rolls of a three-high mill are not reversible. The metal is first pulled forward by the bottom and middle rolls and then lifted mechanically so it can be returned between the top and middle rolls. Blooms and other semifinished products are further processed by rolling and other operations to produce the finished products of the industry. Among the most important finished steel products are sheets, and structural sections which are rolled to a great variety of final shapes by various combinations of rolling processes. Steel plates are produced from slabs.

Continuous rolling mills, developed within the last quarter-century, have revolutionized the art of producing flat-rolled steel. A white-hot slab enters one end of a quarter-mile-long mill, emerging as a ship plate or a thin sheet or strip thousands of feet long. Continuous mills are four-high. A large part of the hot-rolled sheet and strip produced by continuous mills is further cold-rolled on similar mills, especially if it is to be

ROMAINS

used for automobile bodies or tin cans. Tinplate, from which tin cans are made, is cold-reduced sheet plated with tin by the electrolytic or hot-dip process. Cold rolling is done at room temperature. Other hot-rolled products are the starting point for the manufacture of bars of various cross-sections, of tubing, and of drawn wire. See also *Iron*; *Steel*.

Rollins College (*rôl'inz*), an educational institution at Winter Park, Fla. The oldest institution of higher learning in Florida, it was incorporated in 1885. Under the presidency (1925-50) of Dr. Hamilton Holt, editor and peace advocate, Rollins inaugurated the conference plan of education and an individualized curriculum. Classes under the conference plan are limited to 20 students and the institution attempts to establish a closer relationship between the student and the instructor. The faculty numbers about 60, and the student body is limited to 600.

Rolvag (*rôl'vôg*), OLE EDVART, novelist and educator, born on Dønne Island, Norway, April 22, 1876; died in Northfield, Minn., Nov. 5, 1931. Immigrating to the U.S. as a youth, he attended St. Olaf Coll., Northfield, and later joined its faculty. He wrote (in Norwegian) novels about American pioneer life, including "Giants in the Earth" (1927), "Peder Victorious" (1929), and "The Boat of Longing" (1933).

Romains (*rô-mân*'), JULES (born LOUIS FARI-GOULE), author, born in St-Julien-Chapteuil, France, Aug. 26, 1885. Educated at the Lycée Condorcet in Paris, he began his career as a teacher at Laon, then turned to writing. In 1936 he came to the U.S. to teach at Mills Coll. in California. He returned to France in 1937, but was forced to flee when the Germans occupied Paris (1940). He remained in Mexico during World War II, returning to his native France after V-E Day. In October 1946, he was formally accepted



JULES ROMAINS

as a member of the French Acad. He has written poems, plays, and novels, expounding in his works unanimism, a literary philosophy which holds that the typical or unifying attributes of human behavior make truer literature than the odd personalities. Romans' novels include: "Le Bourg Régénéré" (1906), "Lucienne" (1922), the series titled "Men of Good Will" (1932-46), "Verdun" (1939), and "Salsette Discovers America" (1942). Among his plays are: "Le Dictateur" (1926), "Le Roi Macque" (1931). Best known of his poetry is the collection "Chants de Dix Années 1914-24" (1928).

Roman Catholic Church (*rōm'an kăth'ô-lîk chûrch*), the denomination of Christians that recognizes the Pope or Bishop of Rome as its visible head, which assumes to be the only catholic and apostolic church. The word catholic, meaning *universal*, was used by early Christians and continued to be the common designation of the vast number of Christians throughout the Middle Ages. Protestants refused to admit that the church which they left is entitled to call itself catholic in the sense in which the term is used. From the beginning of the Reformation they prefixed the adjective *Roman*, while the Catholics claim the designation *Catholic* without a qualifying adjective. Theoretically the Roman Catholic Church claims spiritual authority on earth. This claim is based on the belief that Christ conferred upon Peter a primacy of jurisdiction, that Peter fixed his see at Rome, and that the bishops of Rome have succeeded him in his prerogatives of supremacy. This view is strengthened by Catholic historians, who refer to Rome as a center at which appeals from other churches on matters of doctrine and discipline were decided, bishops were nominated, and heresies were condemned. However, Protestant historians question whether Peter fixed his see at Rome. They regard the superiority of Rome as a center largely as the result of its political and social power.

The teachings of the Roman Catholic Church are based on the Scriptures and tradition. They are set forth distinctly in the Apostles Creed, the Nicene Creed, and the Athanasian Creed. To these Pope Pius IV, in 1564, added the articles on the invocation of saints, on entire transubstantiation of the eucharistic elements into the body and blood of Christ, and others that distinguish it largely from the Protestant creeds and those of other Christian sects. Seven sacraments are recognized, those of baptism, confirmation, the eucharist, penance, holy orders, matrimony, and extreme unction. In 1854 the dogma of the immaculate conception of the Virgin Mary was added and in 1870, that of Papal infallibility.

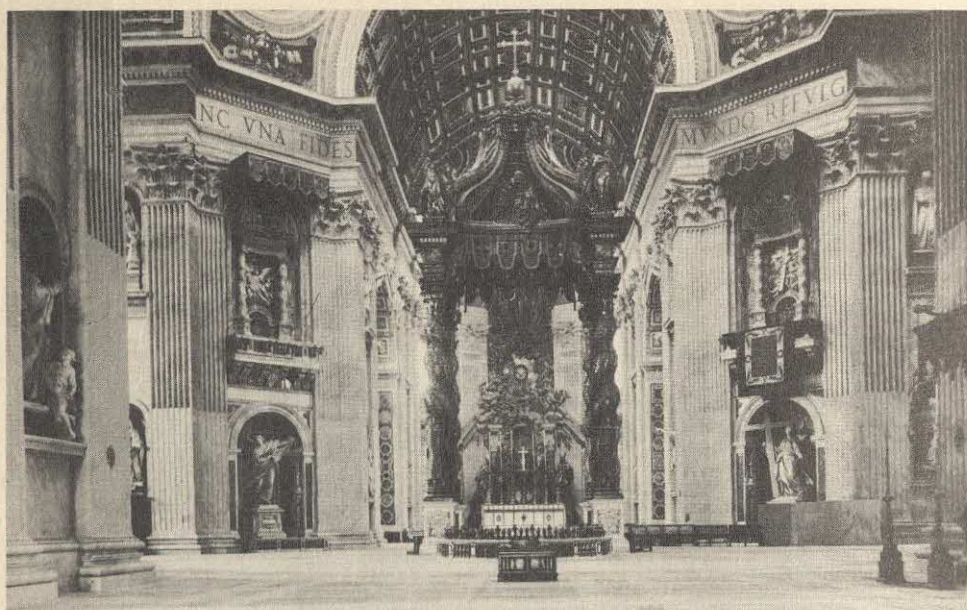
Roman Catholics believe in the existence of a

purgatory and the necessity of confession, and make a clear distinction between doctrine and discipline. *Doctrine* is held to be embodied in the teachings of Christ and his disciples. On the other hand, *discipline* includes the rules laid down for the government of the church by the councils, the religious observances and practices, the administration of sacraments, and confessions and fasting. The membership of the church consists of all persons who, having been baptized, hold to its doctrines and recognized jurisdiction.

The Pope is chosen for life by the College of Cardinals. He is the center of unity and the supreme head, and without his consent no bishop can be consecrated. Cardinals at the head of congregations direct the administration of the church, and these answer to ministers established in Rome by Papal authority. In the Western churches the clergy are bound by a vow of celibacy, but in the Armenian and Greek branches orders are granted to persons married, but marriage after ordination is forbidden. Celibacy is practiced by all the monks and nuns.

A vast monastic system is maintained, which comprises orders known as seculars and religious. Each has its own superiors and is responsible directly to the Pope or to the bishops. Among these orders are the Franciscans, Augustinians, Carmelites, Capuchins, Dominicans, Carthusians, and Jesuits. The missionary work of the Catholic Church takes high rank in all countries of the world. Latin is used almost exclusively in all recognized rites in America, Europe, and the missionary jurisdictions, but various other languages are employed in the East, as Coptic, Greek, Armenian, and Syro-Chaldaean.

Quite apart from its religious importance, the Roman Catholic Church has to be considered as a decisive restorative factor in the cultural and even in the political development of Western civilization. As Greece and Rome had articulated all expressions and concepts of Western civilization from the 7th century B.C. to the 4th century A.D., so the Church manifested them after Constantine I had once made Christianity the state religion (313 A.D.). From then on, the Church ruled the daily life of the people far beyond its original solely religious sphere. Christian ethics, Christian morals, and Christian faith created the laws, influenced government, social structure—in short, all human relations. Naturally, art, philosophical thinking, and, indirectly, even science were shaped by the Church. This dependence of the whole spiritual life as well as the practical and social life of humanity on the concepts of the Church, penetrated deeper and deeper in the life of the people and had its climax in the Middle Ages, especially in the period between the 12th and the 14th cen-



Courtesy Ewing Galloway, N.Y.

VIEW TOWARD THE HIGH ALTAR OF ST. PETER'S IN ROME

tures. From the building of the great cathedrals to their decoration with sculpture and paintings, from the organization of guilds to the regulation of working hours and holidays, from the administration of communities to international treaties, from hospitals to the care of the old, everything had to conform to the teachings of the Church. International developments, leagues, wars, colonizations, were inspired or directed by the Church.

It was only after the beginning of the 15th century, with the growth of the Renaissance in the secular realm and the Reformation in the clerical, that the exclusive power of the Church as *the* intellectual influence began to diminish. Now for the first time in centuries an art developed which did not depend on religious motives for its content, and of much more far-reaching importance, science did not feel compelled any more to conform to the Bible.

Statecraft did not any longer disguise the tendencies for power under the code of propagation of Christianity. Law unashamedly was retraced to Roman secular principles. After the 15th century, the struggle between worldly and Church power went on, finding its climax in the movement of the Enlightenment (*q.v.*) in the 18th century and various materialistic philosophies of the 19th century.

The movement toward separation of Church and state reached its climax in the 19th and 20th centuries even in pronounced Catholic countries such as France and Italy, although the Church held on to many aspects guiding the life of the people. The governments of most nations

confined the influence of the Church to religious matters, defining each other's realms and obligations in treaties, called concordats (*q.v.*). See also *Pope*; *Reformation*; *Vatican City*.

The total membership of the Roman Catholic Church in the U.S. was recently given at 35,846,477. In the same year it maintained 21,327 churches. The total Roman Catholic population of the world has recently been estimated at 509,504,972.

Below is a list of the popes, the dates showing the beginning of their pontificates. The names of those who claimed the dignity of Pontiff, usually called *anti-popes*, are in italics:¹

Date	Name of Pope	Date	Name of Pope
64	St. Petrus	236	St. Fabianus
67	St. Linus	251	St. Cornelius
76	St. Cletus	251	<i>Novatianus</i>
88	St. Clemens	253	St. Lucius I.
97	St. Evaristus	254	St. Stephanus I.
105	St. Alexander I.	257	St. Sixtus II.
115	St. Sixtus I.	259	St. Dionysius
125	St. Telesphorus	269	St. Felix I.
136	St. Hyginus	275	St. Eutychianus
140	St. Pius I.	283	St. Caius
155	St. Anicetus	296	St. Marcellinus
166	St. Soterus	308	St. Marcellus I.
175	St. Eleutherus	309	St. Eusebius
189	St. Victor I.	311	St. Melchiades
199	St. Zephyrinus	314	St. Sylvester I.
217	St. Calixtus I.	336	St. Marcus
217	<i>St. Hippolytus</i>	337	St. Julius I.
222	St. Urbanus I.	352	Liberius
230	St. Pontianus	355	<i>Felix II.</i>
235	St. Anterus	366	St. Damasus I.

From *Annuncio Pontificio*; reprinted by courtesy of "The World Almanac."

ROMAN CATHOLIC CHURCH

ROMANCE

Date	Name of Pope	Date	Name of Pope	Date	Name of Pope	Date	Name of Pope
366	<i>Ursinus</i>	795	St. Leo III.	1073	St. Gregorius VII.	1409	<i>Alexander V.</i>
384	St. Siricius	816	Stephanus V.	1080	<i>Clemens III.</i>	1410	<i>Joannes XXIII.</i>
399	St. Anastasius I.	817	St. Paschalis I.	1086	Victor III.	1417	Martinus V.
401	St. Innocentius I.	824	Eugenius II.	1088	Urbanus II.	1431	Eugenius IV.
417	St. Zosimus	827	Valentinus	1099	Paschalis II.	1440	<i>Felix V.</i>
418	St. Bonifacius I.	827	Gregorius IV.	1100	<i>Theoderius</i>	1447	Nicolaus V.
418	<i>Eulalius</i>	844	<i>Joannes</i>	1102	<i>Albertus</i>	1455	Calixtus III.
422	St. Celestinus I.	844	Sergius II.	1105	<i>Sylvester IV.</i>	1458	Pius II.
432	St. Sixtus III.	847	St. Leo IV.	1118	Gelasius II.	1464	Paulus II.
440	St. Leo I.	855	Benedictus III.	1118	<i>Gregorius VIII.</i>	1471	Sixtus IV.
461	St. Hilarus	855	<i>Anastasius</i>	1119	Calixtus II.	1484	Innocentius VIII.
468	St. Simplicius	858	St. Nicolaus I.	1124	Honorius II.	1492	Alexander VI.
483	St. Felix III. (II)	867	Hadrianus II.	1124	<i>Celestinus II.</i>	1503	Pius III.
492	St. Gelasius I.	872	Joannes VIII.	1130	Innocentius II.	1503	Julius II.
496	Anastasius II.	882	Marino I.	1130	<i>Anacletus II.</i>	1513	Leo X.
498	St. Symmachus	884	St. Hadrianus III.	1138	<i>Victor IV.</i>	1522	Hadrianus VI.
498	<i>Laurentius</i>	885	Stephanus VI.	1143	Celestinus II.	1523	Clemens VII.
	(501-505)	891	Formosus	1144	Lucius II.	1534	Paulus III.
514	St. Hormisdas	896	Bonifacius VI.	1145	Eugenius III.	1550	Julius III.
523	St. Joannes I.	896	Stephanus VII.	1153	Anastasius IV.	1555	Marcellus II.
526	St. Felix IV.	897	Romanus	1154	Hadrianus IV.	1555	Paulus IV.
530	Bonifacius II.	897	Theodorus II.	1159	Alexander III.	1559	Pius IV.
530	<i>Dioscorus</i>	898	Joannes IX.	1159	<i>Victor IV.</i>	1566	St. Pius V.
533	Joannes II.	900	Benedictus IV.	1164	<i>Paschalis III.</i>	1572	Gregorius XIII.
535	St. Agapetus I.	903	Leo V.	1168	<i>Calixtus III.</i>	1585	Sixtus V.
536	St. Silverius	903	<i>Christophorus</i>	1179	<i>Innocentius III.</i>	1590	Urbanus VII.
537	Vigilius	904	Sergius III.	1181	Lucius III.	1590	Gregorius XIV.
556	Pelagius I.	911	Anastasius III.	1185	Urbanus III.	1591	Innocentius IX.
561	Joannes III.	913	Landonus	1187	Gregorius VIII.	1592	Clemens VIII.
575	Benedictus I.	914	Joannes X.	1187	Clemens III.	1605	Leo XI.
579	Pelagius II.	928	Leo VI.	1191	Celestinus III.	1605	Paulus V.
590	St. Gregorius I.	928	Stephanus VIII.	1198	Innocentius III.	1621	Gregorius XV.
604	Sabinianus	931	Joannes XI.	1216	Honorius III.	1623	Urbanus VIII.
607	Bonifacius III.	936	Leo VII.	1227	Gregorius IX.	1644	Innocentius X.
608	St. Bonifacius IV.	939	Stephanus IX.	1241	Celestinus IV.	1655	Alexander VII.
615	St. Deusdedit I.	942	Martinus II.	1243	Innocentius IV.	1667	Clemens IX.
619	Bonifacius V.	946	Agapetus II.	1254	Alexander IV.	1670	Clemens X.
625	Honorius I.	955	Joannes XII.	1261	Urbanus IV.	1676	Innocentius XI.
640	Severinus	963	Leo VIII.	1265	Clemens IV.	1689	Alexander VIII.
640	Joannes IV.	964	Benedictus V.	1271	Gregorius X.	1691	Innocentius XII.
642	Theodorus I.	965	Joannes XIII.	1276	Innocentius V.	1700	Clemens XI.
649	St. Martinus I.	973	Benedictus VI.	1276	Hadrianus V.	1721	Innocentius XIII.
654	St. Eugenius I.	974	<i>Bonifacius VII.</i>	1276	Joannes XXI.	1724	Benedictus XIII.
657	St. Vitalianus	974	Benedictus VII.	1277	Nicolaus III.	1730	Clemens XII.
672	Deusdedit II.	983	Joannes XIV.	1281	Martinus IV.	1740	Benedictus XIV.
676	Donus I.	985	Joannes XV.	1285	Honorius IV.	1758	Clemens XIII.
678	St. Agatho	996	Gregorius V.	1288	Nicolaus IV.	1769	Clemens XIV.
682	St. Leo II.	997	<i>Joannes XVI.</i>	1294	St. Celestinus V.	1775	Pius VI.
684	St. Benedictus II.	999	Sylvester II.	1294	Bonifacius VIII.	1775	Pius VII.
685	Joannes V.	1003	Joannes XVII.	1303	Benedictus XI.	1823	Leo XII.
686	Conon	1004	Joannes XVIII.	1305	Clemens V.	1829	Pius VIII.
687	<i>Theodorus</i>	1009	Sergius IV.	1316	Joannes XXII.	1831	Gregorius XVI.
687	<i>Paschalis</i>	1012	Benedictus VIII.	1328	<i>Nicolaus V.</i>	1846	Pius IX.
687	St. Sergius I.	1024	Joannes XIX.	1334	Benedictus XII.	1878	Leo XIII.
701	Joannes VI.	1032	Benedictus IX.	1342	Clemens VI.	1903	St. Pius X.
705	Joannes VII.	1045	Sylvester III.	1352	Innocentius VI.	1914	Benedictus XV.
708	Sisinnius	1045	Benedictus IX.	1362	Urbanus V.	1922	Pius XI.
708	Constantinus	1045	Gregorius VI.	1370	Gregorius XI.	1939	Pius XII.
715	St. Gregorius II.	1045	Clemens II.	1378	Urbanus VI.	1958	Joannes XXIII.
731	St. Gregorius III.	1046	Benedictus IX.	1378	<i>Clemens VII.</i>	1963	Paulus VI.
741	St. Zacharius	1047	Benedictus IX.	1389	Bonifacius IX.		
752	Stephanus II.	1048	Damasus II.	1394	<i>Benedictus XIII.</i>		
752	Stephanus III.	1049	St. Leo IX.	1404	Innocentius VII.		
757	St. Paulus I.	1055	Victor II.	1406	Gregorius XII.		
767	<i>Constantinus</i>	1057	Stephanus X.				
768	<i>Philippus</i>	1058	<i>Benedictus X.</i>				
768	Stephanus IV.	1059	Nicolaus II.				
772	Hadrianus I.	1061	Alexander II.				
		1061	Honorius II.				

Romance (*rô-mâns'*), in literature, a popular, imaginative work, originally in a romance language (*q.v.*) rather than Latin. The romance, written in prose or verse, features marvelous or

nanostomus *leuciscus*. See also *Stenopodites*.

As a type of literature, the romance first came into real prominence during the four centuries of knighthood, but became especially popular in the 15th and 16th centuries when it came to designate the heroic literature recounting the exploits of knights and heroes. While many of the Greek writings represented men and incidents as they were believed to be, the "Odyssey" is a series of marvelous tales of an essentially romantic character. This and other writings were followed more or less in the view romance of the Middle Ages, and from its original seat in Southern Europe it finally extended to the western and northern countries.

Geoffrey of Monmouth published his Latin "History of the Kings of Britain," which was revised in its present form in 1145. It was later translated into French and versified. The romances of Arthur published in this work account literary interest on the continent as well as in England, where Arthur became a national hero of romance and a leading figure around whom might be grouped the adventures of subordinate knights. French writers treated Charlemagne in much the same manner, but he had the advantage of being a more distinct historical character than Arthur. Other heroes of romance include Alexander, Guy of Warwick, Roland, and Havelok the Dane. In the German "*Nibelungenlied*," the Anglo-Saxon "*Beowulf*," and the Spanish "*Amadis de Gaul*," we have other examples of heroes who figured in romance. Romanticism was revived in English literature in the late 15th and early 16th centuries. This trend featured the historical romances of Sir Walter Scott and a host of writers who succeeded him, such as Alfred Tennyson. Besides furnishing a distinct class of literature, romance influenced the development of the novel.

Romanian Language (*limba română*), the name applied to the spoken language in the southern part of Europe from the sixth century to the 14th. It was a corrupt form of Latin. While some writers treat the languages that grew out of the corruption of Latin as a distinct tongue, it is generally contended that there was no authentic general language of this character, but the dialects spoken had marked similarities. Provençal is the most important branch of this period, but it is followed closely by the Wallachian and Rumanian.

The term *Romance languages* is generally applied by modern writers to the spoken and written tongues that had their origin in Latin, or which owe their development to the extension of the domination and civilization of the Romans. As present and less than six of these languages are used more or less extensively. These include Italian, Spanish, Portuguese, Provençal, French, and

Romanian, Italian is harmonious in form and is distinguished by the rich fullness of its tones. *Spanish* is peculiar for its short, distinct sounds, hard tones, and the adoption of Arabic words. *Portuguese* is the western dialect of the Spanish and has, almost the same words, but the pronunciation is in the style of the French. Grace and delicacy characterize the *French*, which is the most historical of the Romance languages; *Provençal* is closely related to French. *Romanian* is the language of Rumania, but is thought to have come from the northern part of Italy rather than from the Roman colonies of Dacia. All of these languages have elements in common with Latin, hence the study of the latter is helpful in the mastery of the others.

Romanesque Style (*ró-man-ésk' stíl*), in art, originating from the 10th century to the 12th century in Europe; characterized in architecture by the round arch and preference for close walls, in painting by miniatures and mosaics, in sculpture by a highly developed technique of ivory carving, and the beginnings of bronze carving. The cathedrals of this time were decorated by impressive sculptures closely allied to the architectural form.

Pamphila (*vilula*?), See *Pamphila*.

Roman Numerals (*ro' man nu'me- rals*), the letters used by the ancient Romans, and to a certain extent in present-day writing and printing, to denote arithmetical numbers. The table of Roman numerals is based on the following symbols: I = 1, II = 2, etc., V = 5, X = 10, L = 50, C = 100, D = 500, M = 1,000. All others are built upon these by combinations, either by adding or by subtracting the first number from the second; e.g., XC = 90, CD = 400.

Thymus (*ch-mi'ah*), common. See *Codrus*, R.

Romanov (*ro-mă'nof*), Russian *dynasty* (1613-1917). The founder of the dynasty was Michael Feodorovich Romanov (1596-1645), whose mother, though his grandmother, was a descendant of Rurik, the founder of the Russian Empire. His successors were his son Alexis I, Feodor II, Ivan V, Peter I (the Great), and Peter II, who died in 1730. Then the succession of the female Romanovs began with Anna Feodorovna and ended in 1761, when Empress Elizabeth died. The son of the Duke of Holstein-Gottorp and Anna, the sister of Empress Elizabeth, succeeded the throne as Peter III (1761), establishing the dynasty of Holstein-Gottorp-Romanov. The last of this line was Nicholas II, who was killed in 1917.

Epistles (or Letters). Another 26, a book of the New Testament, written by St. Paul to the Church of Rome. It was probably written at Corinth, where St. Paul remained about three months, and is assigned by commentators to the year 58 or 59 a.d. The epistle consists of two principal parts, one of which is argumentative and

the other is hortatory. It contains a complete statement of the doctrine held by the writer, including justification by faith as a means of salvation to all men, Gentiles as well as Jews. He deplors the fact that many Jews rejected Christ and admonishes the Romans to embrace the spirit of humility, which will enable the strong to bear with the weak. The book is concluded with various salutations and directions. The authenticity of the epistle has been generally conceded.

Romanticism (*ró-mán'ti-sím*), the name applied to a movement in the arts which has been variously defined as a revolt against the rationalism of the 18th century, a return to nature, and an exaltation of the emotions over the intellect. In literature, the romantic movement is generally thought to have begun around the middle of the 18th century with the works of Jean Jacques Rousseau (*q.v.*), who advanced the doctrine that man is created good but is corrupted by evil institutions and laws. An outgrowth of this doctrine is the idealization by early romantic writers of the primitive, nature, the peasant, rebellion against social conventions, and the child. Notably early French romantics were Chateaubriand, Madame de Staël, and André Chénier; in the 19th century, the leading figure was Victor Hugo. The finest flowering of German romanticism appears in the works of Goethe, Schiller, and Heine. Fichte and Schelling were the chief philosophers of the German romanticism. English romanticism was ushered in with the first publication (1798) of "Lyrical Ballads" by Wordsworth and Coleridge. Later exponents of the movement were the poets Byron, Shelley, and Keats and the critics and essayists Hazlitt, Lamb, and De Quincey. All world literature of this period mirrors the characteristics of romanticism; the movement was not limited to poetry and philosophy but was reflected in novels (such as those of Scott, George Sand, Dumas, and Dumas père) and in tales of horror and the supernatural (such as those by E. T. A. Hoffmann and E. A. Poe). Among the notable romantic writers in the U.S. were Poe, Nathaniel Hawthorne, R. W. Emerson, J. F. Cooper, H. D. Thoreau, Walt Whitman, and Herman Melville. In American philosophy, New England Transcendentalism (*q.v.*) sprang directly from romanticism. Toward the end of the 19th century, the romantic movement in literature was overwhelmed by the new impetus toward realism; its influence is still potent, however. Romantic literature and the emotional currents which produced it also had a strong influence upon the music and art (*q.v.*) of the 19th century.

For the various national movements, see under articles on the respective countries, LITERATURE; also separate articles on the authors mentioned here.

Romanus (*ró-mán's*), born Byzantine emperor. ROMANUS I (died 948), called STASIMACHUS, was an Armenian who usurped the throne of his nephew, Constantine VII, in 945, ruling until 948. ROMANUS II (948-963), the son of Constantine VII, reigned from 959 to 963. ROMANUS III (963-1034), called ARDIEN, became emperor through marriage to Zoë, heiress of Constantine VIII; they reigned jointly until 1034. ROMANUS IV (died in 1071), called DIAGENES, married and reigned (1068-71) with Eudokia, widow of Constantine X. His defeat in 1071 by the Seljuk Turks led to the loss of the Byzantine territory in Asia Minor.

Romberg (*róm'berj*), composer, pianist, born in Szeged, Hungary, July 25, 1887; died in New York City, Nov. 9, 1955. Educated in Vienna for an engineering career, he pursued the study of music as a sideline and on coming to the U.S. (1910) soon established himself as an orchestra leader. His first opera, "Mephisto," was produced in 1917. Romberg later wrote more than 70 musical shows, including "The Student Prince" (1924), "Flower Time" (1926), "The Desert Song" (1926), "The New Moon" (1927), and "Up In Central Park" (1928). He also wrote the scores for a number of motion pictures. Romberg's music is characterized by its romantic lyricism.

Rome (*róm*), county seat of Floyd County, Georgia, on the Southern and the Central of Georgia R.R.'s, at the confluence of the Etowah and Oostanaula rivers, 37 m. n.w. of Atlanta. The city lies in a region rich in mineral resources, including iron, limestone, lime rock, talcum, magnesite, and shale; there are many limestone caves in the vicinity. Situated in a farming and timbering area, Rome is a cotton market and shipping center and has manufactures of textiles, clothing, shoes, and lumber and wood products. Horne Hall, for women is located here, as are the state school for the deaf and a state hospital for tubercular patients. In 1890 Horace de Ben camped on the site of Rome. Founded in 1792, the city was incorporated in 1825. In the Civil War, Gen. N. B. Forrest captured a Federal cavalry detachment near here (1862); in 1864 Union forces under Gen. W. T. Sherman took the town and destroyed its industrial facilities. The town of Marble Hill, site of Marble Hill School for Girls and other institutions, is nearby. Population, 1940, 16,016; 1950, 22,475.

Roma, a city in central New York, a county seat (with Oneida) of Otsego County, on the Mohawk River and the New York State Barge Canal, about 35 m. n.w. of Albany. Roma is served by the New York Central and the New York, Ontario & Western R.R.'s and has manufactures of wool wares, cables, and silks, copper and brass housewares, soap, airplane parts, automobile and airplane radiators, sporting goods, and clothing.

ROME

The surrounding countryside produces large amounts of grain, cheese, butter, and fruit. State schools for the deaf and for mental defectives are located here. The city occupies the site of the Revolutionary Ft. Stanwix, where (during a siege by the British in 1777) the Stars and Stripes is said to have been unfurled in battle for the first time. Rome was settled in 1760, incorporated as a village in 1819, and chartered as a city in 1870. Population, 1940, 34,214; 1950, 41,682.

Rome, in Italian, *ROMA*, a city in central Italy, in the *compartimento* (region) of Latium, the capital of the republic of Italy and of the province of Roma. In ancient times it was the capital and center of the Roman Empire, and, because it contains the independent state of Vatican City (*q.v.*), it is the center of the Roman Catholic Church. Rome lies on both banks of the Tiber River, about 15 m. from its mouth; the city proper is situated on the left bank of the river, on the Seven Hills (Capitoline, Aventine, Caelian, Viminal, Palatine, Esquiline, and Quirinal), while the papal quarter, including Vatican City, is on the right bank. Population, 1951, 1,695,477.

ANCIENT ROME. The traditional date for the founding of Rome and the one from which the ancient historians reckoned the city's history is April 21, 753 B.C. According to legend, on this date the twins Romulus and Remus (*qq.v.*) settled here. The actual founders are regarded as Latins, who left Alba Longa in a colony to establish an outpost against the Etruscans. No reliable account of the early history of Rome is in existence, but the early inhabitants were farmers or shepherds, who lived for protection within their fortifications on Palatine Hill. Rome was a prosperous city in Etruscan times (see *Etruria*). The city was destroyed by the Gauls ca. 390 B.C., one of many incidents of destruction, followed by rebuilding, in the city's history.

The imperial period was one of the most extensive periods of construction. When Augustus Caesar became emperor (ca. 30 B.C.), he initiated many building projects, introducing the extensive use of marble for decoration. But the groundwork for a great city was laid long before his time. The low places between the hills were improved by grading in the early history of Rome, and a remarkably thorough system of drainage was constructed. The great aqueducts were begun by Appius Claudius Caecus in 312 B.C., and water was brought to the city from springs several miles distant. See also *Aqueduct*.

The Campus Martius (*q.v.*) was originally a marshy tract lying between Capitoline Hill and the Tiber. It owes its name to a prehistoric altar of Mars once erected in it. The theater of Pompey, the first permanent theater of the city, was erected here in the first century B.C. Erected later was the Pantheon (*q.v.*). On Capitoline



ROME. SPANISH STEPS

Hill was the splendid temple of Jupiter Capitolinus. Near it was the theater of Marcellus, finished by Augustus some 20 years after the beginning of his reign. The Colosseum was nearby. An immense oval building, it was used for gladiatorial exhibitions, in which many Christian martyrs suffered death. It was about 600 ft. long, 500 ft. wide, and 160 ft. high, with a capacity of 50,000 spectators. The largest structure, known as the Circus Maximus, was situated in a valley between the Palatine Hill and the Aventine Hill; its capacity, according to Pliny, was 250,000 persons, a figure considered grossly exaggerated by modern archaeologists. The ruins of the Colosseum are still to be seen.

As Rome developed into the capital of the empire, it was enlarged many times. Older sections were built over, and the valleys gradually filled in. Some elements of older structures were incorporated in newer ones. Among the structures still known are the public baths, called *thermae*. Traces of the *Thermae* of Titus remain on Esquiline Hill, and the famous Diocletian bath has a few portions, not the bathing facilities, still in use. The emperors enlarged the imperial palace, built many temples, and were responsible for many arches and monuments. In enlarging the Forum (*q.v.*), they built new groups of buildings for public purposes. In the forum begun by Julius Caesar, the Temple of Venus Genetrix was erected. The Forum Pacis (forum of peace) was built by Vespasian. Trajan's column (97 ft. high), erected A.D. 113, is still standing. Near the Forum are the triumphal arches of Severus, Titus, and Constantine. Hadrian's tomb, used in medieval times as a citadel, is called Castel Sant' Angelo. Some catacombs (subterranean galleries used as burial and meeting places) and remnants of street pavements may still be seen in many parts of the city. Across the Tiber were many bridges, several of

which are intact. It is estimated that the population of Rome in the time of Augustus was 1,300,000, but in the time of Trajan it is said to have reached about 2,000,000.

MODERN ROME. At present Rome extends to both sides of the Tiber, as did the ancient city. However, it is difficult to determine whether the limits coincide with those of ancient Rome, which probably extended some distance beyond the present boundary in some directions. It has substantial walls, those on the east bank of the Tiber dating from the time of Aurelian, in the 3rd century. On the left bank of the Tiber are three sections of the city: the *Campus Martius*, in the north; the ancient part, in the south; and the more modern section, in the east and north-east. The *Campus Martius* is famous for the *Piazza de Venezia*, *Capitoline Hill*, and architectural splendors, as well as fine shops. Here are also the government offices, the Senate, Chamber of Deputies, and the Univ. of Rome. In the modern section of Rome are the metropolitan area and the artists' quarter. Here are also found the impressive *Scala di Spagna* with its 137 steps, and the famous fountain, the *Fontana Trevi*, dating from 1762. The right bank section contains the Vatican quarter (*il Borgo*), and further north, the *Prati*, with its modern apartment buildings. Embankments have been constructed along the Tiber to prevent overflows, thus guarding against damages and disease common to the city in former times. Through the medium of vast excavations it has been possible to restore many historic structures and monuments, notably the Forum Romanus, the Temple of Castor and Pollux, and the famous Sacred Way, which was the great central street of the ancient city. Many alterations and modern improvements have been made in the piazzas, parks, boulevards, and monuments by careful city planning. Modern buildings, new squares, demolishing of old houses of no historic value, all these characterize present-day Rome. In the center of Rome a huge sports center was constructed.

BUILDINGS. One of the notable buildings in Rome is the Church of St. Peter, the finest and largest structure of its kind in the world. It is decorated with monuments and paintings by the great masters. Besides this place of worship, the city has numerous other churches. Many of these are memorial churches and are opened only on the day of the year assigned to the saint to whom they are dedicated. The huge palace of the Vatican (*q.v.*) adjoins St. Peter's and is the residence of the Pope. It contains the Vatican library, a picture gallery, and splendid museums. The palace on the Quirinal, formerly a summer residence of the Popes, was occupied by the King of Italy after 1870, but the *Palazzo della Cancelleria* is still occupied by

the Roman Catholic Church. Rome is noted for many great educational institutions, the most important being the Univ. of Rome, founded by Pope Boniface VIII in 1303. It has a fine collection of books, botanic gardens, and an astronomical observatory. Rome has a system of common schools, which is maintained by public grants and taxation, but much of the instruction is in parochial schools and monastic institutions. In addition to the university, Rome also has other institutions of higher learning, including a women's college, and architectural and engineering colleges. Rome's opera has attracted many outstanding stars. The city is the seat of numerous hospitals, charitable institutions, academies, art galleries, and many large libraries.

LATER HISTORY. Rome was identified with the rule of the popes from the downfall of the Roman Empire, in 476 A.D., until the rise of United Italy, in 1871. An army under the constable of Bourbon captured and sacked the city in 1527, and Napoleon occupied it in 1798. He made Pope Pius VI a prisoner and carried him to France, and soon after a Roman republic was established. A republican army under Garibaldi and Mazzini expelled Pope Pius IX from Rome in 1848, but he was restored to power by a French army sent the following year to consummate the overthrow of the new republic. With the fall of the French Empire in 1871, the union of the Italian states became practical. In July of the same year the city became the capital of United Italy, when the king, Victor Emmanuel, took up his residence in the Quirinal. During World War II, Rome was subjected to military operations and air attacks of the United Nations forces. It fell into Allied hands on June 4, 1944. Since its liberation much of the war-inflicted damage has been repaired and many old Roman churches have been rebuilt.

INDUSTRIES. As compared with other cities of the same size, Rome is not important as a center of commerce and industries. It is the converging center of several railroads, but has only a very limited water-borne trade, since the Tiber is navigable only for small vessels. Grain, wine, and cattle are imported. Most of the export trade is carried on by way of Fiumicino, its seaport on the Mediterranean, with which it is connected by railway. Among the manufactures are silk and woolen goods, toys, jewelry, musical instruments, leather, flour, soap, macaroni, and artistic reproductions. Large quantities of art products are made, such as cameos, mosaics, bronzes, and church ornaments. Motion-picture studios operate just outside the city. Rome has long been a gathering place for tourists, travelers, and students on account of its historical treasures. Its position as "the Roman Catholic capital" of the world has also drawn numerous visitors. Population, 1930, 886,928; in 1951, 1,701,913.



ROMULUS AND REMUS, LEGENDARY FOUNDERS OF ROME

Present sculpture of the 19th century A.D.; the twins were added in the 17th century

Rome, an ancient nation of Southern Europe, one of the most powerful and historic of antiquity. The history extends from the founding of the city of Rome, in 753 A.D., as its downfall, in 476 A.D., over 22 centuries. This long span of time may be divided into three periods, according to the form of its government. They include the kingdom from 753 to 509 A.D., the republic from 509 to 27 A.D., and the empire from 27 A.D. to 476 A.D. It is thought that the Latins who founded Rome came as a colony from Alba Longa, and that the latter city was founded by Ascanius, a descendant of legendary Trojans.

Early History. There are many accounts of the founding of Rome, but the one most generally accepted is that the descendants of Troy by the Greeks spared many fugitive Trojans to live in Italy, where they were received kindly by King Latinus. Rhea Silvia, daughter of a deposed king of Italy, was the mother of Remus and Romulus, two children who were ordered killed by the reigning king, but were discovered and saved by a shepherd. Romulus became the founder of Rome, in 753 A.D., and was the first of its kings. He encouraged settlement by constructing fortifications to protect the citizens against hostile tribes, building them in such a manner that the people could reside within the fortifications while they tilled the soil and moved their herds to the adjoining region. It is probably true that the early settlements were greatly enlarged by *Arcyons* coming from Asia by way of Greece, and that the cities of Latium formed a confederacy with Alba Longa at its head. The settlements grew rapidly, expansion being due largely to the fertility of the soil and natural advantages in the way of commerce and navigation.

Kingdom of Rome. The early government of

Rome was monarchical, being administered under a prince, who was assisted by a senate and an assembly. However, the city was frequently attacked by the Sabines, a tribe occupying the upper valley of the Tiber, who finally captured the Quirinal and Capitoline Hills. After many years of conflict, the two tribes became united and formed the two patrician houses known as the *Eoman* and the *Quindian*, both having seats in the senate, while the king was taken alternately from each. Later the city was conquered by the Etruscans, who placed the Tarquins on the throne and transformed the city with elegant structures in the Etruscan style of architecture. They extended the city to include the Seven Hills, enclosing the whole with a wall that enclosed eight centuries. It was due to the Etruscans that Rome became the head of the 30 Latin cities within 150 years after it was founded.

As the adjoining cities of Italy were conquered, many people of foreign birth were brought or voluntarily moved into the city. This element grew due to the plebeians, while the Latins, Sabines, and Etruscans constituted the class known as the *patricians*. However, the Tarquins were the heads of the plebeians. The nobles, becoming dissatisfied with the abuses of the plebeian power and the corresponding weakness of the kings, joined other Latin cities to expel their Etruscan rulers, which they did in 509 A.D. The following is the chronology of the Roman kingdom, as generally given by historians: Romulus, 754-726; Numa Pompilius, 726-673; Tullus Hostilius, 673-643; Ancus Marcius, 643-616; Tarquinius Priscus, 616-579; Servius Tullius, 579-535; and Tarquinius Superbus, 535-499.

Republic of Rome. With the establishment of the republic, in 509 A.D., two chief magistracies

were chosen. These were at first called *procurator*, but the name was later changed to *senate*, and a constitution modified by Servius was adopted. Conflicts continued between the Romans and the Etruscans until 505 B.C., when the latter were subdued, and Rome became the master of all Italy. However, conflicts of a political character were constant between the patricians and the plebeians. The former were descendants from the first settlers, and were rich, proud, and exclusive, claiming all the offices and emoluments of the government. On the other hand, the plebeians were the common people. They were denied the rights of citizens and were not allowed to intermarry with the patricians. Besides, they were obliged to serve in the army without pay and their want of means to carry on industrial enterprises at home rendered them vulnerable to the patricians, who reduced them to a form of slavery and sold them as slaves when they were unable to pay their debts.

The plebeians urged their demand for equal privileges with the patricians for the first ten years of the republic and gradually their demands were complied with, a concession hastened by the fact that they formed the principal part of the army. In 445 the law against intermarriages was abolished. Then the plebeians were granted three military tribunes with consular powers and in 365 B.C. their victory was finally won, when they succeeded in equal numbers in wearing the dictatorship, the censorship, the praetorship, and the right to be consul and censor.

The period of contest between the patricians and plebeians was disturbed more or less by foreign wars and internal strife among the different tribes. Rome was captured and nearly destroyed by the Gauls in 390 B.C., and the invaders agreed to remove the Apennines only on condition that they receive a heavy ransom. This invasion was in some respects beneficial to the Romans, since they were deeply impressed by the courage and strength of the Gauls, and it once began to rebuild their city. The next war took place in 356 B.C., against Pyrrhus, a Greek colony in southern Italy, and resulted in the subjugation of the latter. Thus triumphant at home, Rome entered upon the First Punic War, in 264, and continued this contest against Carthage until 201 B.C. The Second Punic War occurred in the period from 218 to 201 and the Third from 149 until 146 B.C. These wars with the Carthaginians covered a period of about 200 years. Carthage, a city of Africa that had flourished over 700 years and numbered among its inhabitants, was utterly destroyed and the Carthaginian territory became the Roman province of Africa. While Hannibal was commanding the Carthaginians, he made a treaty with Philip, King of Macedonia, and out of this grew three Roman wars against the Mac-

edonians, which culminated in the Battle of Pydna in 168 B.C. The results of these wars were signed within a brief period and included the downfall of Carthage. In 146 B.C. Macedonia became a Roman province, Carthage fell the same year, and Carthage was captured, and all of Carthage was made the Roman province of Achaea. Victorious in Carthage and Carthage, the Romans began to look toward the East for conquest. They had already defeated the Persians at Thermopylae in 480 B.C. and had overthrown their power on the field of Magnesia, in Asia Minor.

The Roman nation extended its influence by the year 133 B.C. so as to include the vast region from the Adriatic to the Bosphorus, besides a part of Northern Africa and much of Western Asia. Its soldiers had come in contact with both civilized and savage opponents, while many parts of Italy had been swept with fire and the sword by Hannibal. Each of these circumstances had brought about material changes in economic conditions, since there was need for removing rural prosperity, and the capital city needed a more rigid government. Conditions hastened on the civil wars, and Rome in rapid succession passed through conflicts that appeared to destroy the republic. The first material internal disturbance arose over the measure introduced by Titus Gracchus in 133 B.C. This reform sought to have the public land assigned in small farms to the natives with the view of giving them more a homestead, and proposed in addition that those receiving land should be allowed access from the public treasury to build houses and buy cattle. This measure was opposed by all the friends of the common people, for it was opposed with great vigor by the nobles, and resulted in the assassination of Gracchus and his leading supporters by agents of the aristocracy. Nine other legions occupied the shores of Sicily, which occasioned the war against him in 121 B.C., known as the Jugurthine War.

The invasion of Rome by the Yastini and Cimbri began in 113 B.C. These were followed by the Social War, due to the question of admitting Italians to citizenship, in 91 B.C.; the first Mithridatic War, in 88 B.C.; the great Mithridatic War, in 73 B.C.; and the Jugurthine War, in 71 B.C.; and in the meantime several wars were resulting from disagreements among the generals and provinces. The leading ones of Rome in that period were Julius Caesar, Pompey, Cato, Cicero, Crassus, Pompey, and Cato the Elder. The first triumph was concluded by Pompey, Crassus, and Cato in 66 B.C., forming a compact so strong that they were able to manage the affairs of the republic at their pleasure, and it was assumed by Pompey marrying Julia, only daughter of Caesar. Soon after followed the banishment of Cato and the appointment of Cato to Cyprius,

while Caesar became consul and was afterward appointed as governor of Gaul. A civil war between Caesar and Pompey began in 49 B.C., and, though Pompey had boasted that he could raise an army by stamping his foot upon the ground, he was obliged to flee from Rome without striking a blow. A battle between the two rivals occurred on the plain of Pharsalia, Greece, in 48 B.C., which resulted in the defeat of Pompey and he was obliged to flee to Egypt, where he was assassinated. Cleopatra was elevated to the throne of the Ptolemies by Caesar and the Syrians were so completely defeated that Caesar sent his celebrated dispatch: "I came, I saw, I conquered." Victorious in the East, Caesar hastened to celebrate a four-day triumph in Rome, where he was created dictator for 10 years and censor for three. In the meantime he attained other victories and established peace in Spain.

The government of Caesar was administered honestly. During his administration canals and highways were built, the poor were given employment, Rome was enlarged and beautified, and his vast dominion from the Euphrates to the Rhine was guarded with remarkable vigor. The senate created him dictator for life, but differences and jealousies arose that finally terminated in his assassination in 44 B.C. Caesar's death was followed by the second triumvirate, which was concluded by Antony, Octavianus, and Lepidus. By its terms Brutus, Cicero, and Cassius were proscribed. Cicero was shortly after beheaded and Brutus and Cassius met their opponents in the Battle of Philippi in 42 B.C., but their complete defeat caused them to commit suicide in despair. Rome was divided between Octavianus and Antony, the former receiving the West and the latter the East. A civil war between the two great leaders terminated in the naval Battle of Actium, in which Antony and Cleopatra were defeated and fled to Egypt. The Battle of Actium ended the civil wars and the Roman republic. Octavianus, now master of the civilized world, became Emperor in 31 B.C., assuming the title of Augustus.

EMPIRE OF ROME. Although an empire had been established, Augustus made no radical changes, but kept all the forms of the republic. This course was necessary, since a radical assumption of power would have resulted in his deposition. However, he really exercised absolute sway and all the offices of trust were centered in him, including those of pro-consul, consul, censor, tribune, and high priest. The empire at that time contained 120,000,000 inhabitants. It extended from the Euphrates on the east to the Atlantic on the west, and from the deserts of Africa on the south to the Danube and Rhine on the north. Fully 100 different nations were included in this vast dominion, each speaking its own language and worshiping its own gods.



ROMAN SOLDIERS

Relief from the column of Marcus Aurelius, 2nd century A.D.

The Age of Augustus was one of general peace and prosperity. It was the design of the emperor not only to maintain schools, extend literature, and effect internal improvements, but also to Romanize his subjects. This had already been accomplished in Gaul and was under way in Germany, but Arminius, a brave leader of the Germans, aroused his countrymen in opposition. In the year 9 A.D., Varus and his entire army in Germany met destruction, and Roman authority never was fully re-established in the country of the Teutons. The most important historical event of his reign was the birth of Christ, in the time of Herod the Great, Roman king of the Jews. On the death of Augustus, in 14 A.D., Tiberius, his stepson, became emperor by a decree of the senate. The emperors succeeding Tiberius were Caligula, in 37; Nero, in 54; Vespasian, in 69; Titus, in 79; and Domitian, in 81. Domitian was followed by the emperors Nerva, Trajan, Hadrian, Antoninus Pius, and Marcus Aurelius, who reigned from 96 until 180 and gave Rome peace and prosperity. Aurelius was noted, both for virtue and wisdom, but the later years of his reign were disturbed by the invasions of Germans (see *Germany: History*) and Slavs (q.v.). He was succeeded by his son, Commodus, in 180, and from that time Rome began to decline.

The decline of Roman power is due to many causes. It may be said that the most prolific were the rise of factional militarism, the continuous invasions by the Goths, Germans, and Persians, the concentration of wealth into the hands of a few, and a low state of political



Courtesy Canadian Pacific Steamships

ROMAN FORUM. ARCH OF SEPTIMIUS SEVERUS, 2nd CENTURY A.D.

and moral aptitude. During the 1st century Christianity spread rapidly over the Western Empire and became a potent force in displacing the gods of the Romans. Though tolerant of all religious beliefs in every nation they conquered, the Romans persecuted the Christians, because they alone refused to offer sacrifice to the gods of the empire. They absented themselves from the games and feasts and were accustomed to hold their meetings at night. Soon they came to be regarded as enemies of the state and were persecuted by even the best rulers, as Trajan and Diocletian. A marked change came about also in Roman citizenship, since the emperors were of provincial birth and the army consisted chiefly of Germans and Gauls.

Constantine was declared emperor by his

troops in 306 and, after overthrowing five rival contestants for the throne, he became sole ruler in 324. His reign marked an era in the history of the world, for he established Christianity as the state religion and removed the capital from Rome to Byzantium, a Greek city on the Bosphorus, which was renamed Constantinople in his honor. He made the government absolutely despotic by establishing a court of titled nobility and weakening the power of the army. While Christianity made it possible for the empire to resist three centuries of barbaric invasions, it did not supply enduring strength. Julian the Apostate sought in vain to restore the old religion. Valens taxed every energy of the empire to repel the invading Goths, who pressed forward to the very gates of Constantinople, but he was captured and burned.

Theodosius the Great for a few years delayed the division of the empire by enlisting 40,000 Goths under the eagles of Rome, but at his death, in 395, a division occurred between his two sons. The Eastern, or Byzantine Empire, passed to his son Arcadius and the Western Empire, to Honorius. Continuous jealousies between the two empires greatly weakened both governments and, to save his dominion from ruin, Arcadius induced the invaders from the north to turn against Italy. The three great barbaric leaders were Alaric the Goth, Attila the Hun, and Genseric the Vandal. Alaric captured Rome in 410, while Attila swept like a scourge across Italy and only spared Rome from utter destruction, in 451, at the entreaties of Pope Leo. Genseric secured control of the Mediterranean and sailed up the Tiber in 455. Pope Leo met Genseric to entreat that the city might be spared, but he turned it over to the warriors to be sacked. He carried 30,000 slaves and vast treasures from Rome to Carthage, where he had founded an empire on the site of the city destroyed by the Romans six centuries before. Rome was now at the mercy of Odoacer, a German chief, who commanded that Romulus Augustulus, the last Roman monarch, lay down his useless scepter. The emperor yielded in 476, and thus passed away the great Roman Empire. It is a curious incident in history that both the founder and the last sovereign of Rome bore the name of Romulus. Byzantium continued a recognized nation for a thousand years after the fall of Rome, ending with the capture of Constantinople by Mohammed II, in 1453. Rome was a province of the Byzantine Empire until 800, when Charlemagne received its crown, though its history had become merged into that of Italy some centuries before. See *Italy*, HISTORY.

LANGUAGE. Politically there was a clear distinction between Rome and Latium, but the language of the two sections was the same and it was called *Latin*. It belongs to the Aryan family of languages and was perhaps spoken in several dialects as early as 1500 B.C. It is probable that the Latin and Greek came originally from the same source, since there is a manifest connection between the two languages. Classical Latin was formed in the period when Rome was a republic and an empire, though during the last two centuries of its history many foreign words were injected through contact with other languages, and by the 8th century it ceased to be spoken as a distinct tongue. The tongues developed from the Roman include the modern Romance languages, which are chiefly the Italian, Rumanian, Spanish, Portuguese, and French. The literature and language of the Latins were preserved in remnants of the great libraries, which were carried by the clergy to the monasteries in the Middle Ages, and were afterward brought to the great

libraries of Europe, particularly those of Rome. Many of the leading writers of Europe, following the revival of learning, wrote largely in Latin, and both the language and its literature were subjects of profound interest in all the higher institutions of learning for many centuries. All the modern languages of European people contain a large proportion of Latin words, the Latin addition to English being made at the time of the Norman conquest. Latin is characterized by a peculiar accuracy in expressing thought. This characteristic, plus the fact that it supplies the roots of many derivative words, causes it still to hold its place of prominence as a study in secondary and higher institutions of learning.

LITERATURE. Roman literature was limited to a few writings for about five centuries after the founding of Rome. It may be said that the "Law of the 12 Tables," prepared about 450 B.C. and hung up in the Forum, was the first prose composition of importance. The earliest writings were fashioned almost exclusively after Greek models and their lyric, heroic, and dramatic meters came from the Greeks. Rome had elementary schools as early as 450 B.C., where reading, arithmetic, writing, and music were taught. Many of the teachers were Greeks and the children of wealthy families were sent to Greece to complete their education, but excellent higher schools and colleges were later established in all the Roman cities. The first translation of Greek classics into Roman was made by a Greek slave who came to Rome about 250 B.C. He also wrote and acted plays inspired by Greek writings. "The Origines" is a work written by Marcus Porcius Cato in the 2nd century. It consists principally of a history of the origin of Rome and several other cities of Italy. Ennius, a Roman of the same period, introduced a new style of literature, somewhat resembling the Greek. His writings are largely poetical history and his "Annals," a poetical history of Rome, was for two centuries the national poem. He was honored by having his bust placed in the tomb of Scipio. The writings of Plautus belong to the early part of the 2d century, and are noted for their vigorous and brilliant wit. Terence, a learned and graceful humorist, who flourished about the middle of the 2d century, turned attention to greater refinement and more cultured forms of expression.

The Latin tragedies of the early Roman period were copied from the masterpieces of Sophocles and Euripides. Their comedies were translated from Aristophanes and other writers, their philosophy was borrowed from the Portico and the Academy, and their orators, even in the palmiest days, patterned their speeches after those of Demosthenes and Lysias. To the 1st century B.C. belong the illustrious names of Varro, Cicero, Virgil, Horace, Livy, and Sallust. Varro founded

large libraries and a museum of sculpture, cultivated the fine arts, and sought to awaken literary tastes among his countrymen. He wrote on history, theology, philosophy, and agriculture. Cicero is the most eloquent of all the Romans. He is famous as an essayist, orator, and letter writer; his principal productions include his four orations on the "Conspiracy of Catiline." The Roman schools used his orations for lessons and many of his essays still are familiar Latin textbooks. Virgil and Horace are well known poets of the Augustan age. Virgil's "Aeneid" is modeled after the Homeric poems and has been used as a textbook up to the present time. Livy wrote 42 volumes of Roman history, beginning with the fabled landing of Aeneas, and closing with the death of Drusus in the year 8 B.C. Sallust is another historian of eminence, his most noted writings being the "Conspiracy of Catiline" and the "Jugurthine War."

The noted writers of the 1st century A.D. include Seneca, Juvenal, Tacitus, and the two Plinys. Seneca was a brilliant orator, poet, and Stoic philosopher. His writings are remarkable for their moral purity. They include "Ethical Essays," "Tragedies," and "Instructive Letters." Juvenal produced works remarkable for their satire and eloquence. Tacitus wrote in a grave and stately, though sometimes sarcastic, style. His writings include "History of Rome," "Life of Agricola," and a treatise on Germany. Pliny the Elder is the author of "Natural History," a work of 37 volumes, covering the whole range of scientific knowledge of his time. Pliny the Younger was a charming letter writer; his writings extant include the "Epistles" and the "Eulogium upon Trajan." Quintilian was the most eminent rhetorician and literary critic of Rome. He lectured for 25 years and afterward published his discourses in a work entitled "Institutes." His writings belong to the early part of the 2d century. Other writers of Rome include Emperor Marcus Aurelius, St. Jerome, and St. Augustine. Marcus Aurelius is remembered as a Stoical writer, St. Jerome as the translator of the Bible into Latin, and St. Augustine as the author of "The City of God" and of "Confessions."

Rommel (rôm'l), ERWIN, army officer, born Nov. 15, 1891, in Heidenheim, Germany; death announced in October 1944. He had his military education in Stuttgart and served in World War I as a lieutenant. During World War II, he commanded tank divisions in France (1940), and in 1941 headed the German *Afrika Korps*. At first his troops won sensational victories in Libya, driving the British back into Egypt, but later he was driven back himself and his army, from which he had been recalled to Germany in March 1943, surrendered to the Allies in May. In 1943, he also commanded the German forces in Italy



Courtesy Henry E. Huntington Library & Art Gallery,
San Marino, Calif.

THE BECKFORD CHILDREN

PAINTING BY GEORGE ROMNEY

for a few months. Later in the year he was shifted to France, where he was appointed ground commander of the German armies. Although he had been regarded as one of the most active members of the Nazi party, he was suddenly recalled, and was later accused of treachery. He died under mysterious circumstances in July 1944.

Romney (rôm'nî), GEORGE, painter, born in Dalton-in-Furness, Lancashire, England, Dec. 26, 1734; died in Kendal, Westmorland, Nov. 15, 1802. He was instructed by his father and in 1753 became a pupil of Christopher Steele, a painter in Kendal, where, five years later, he had his own workshop until 1761, when he went to London. Travels to France (1764) and to Rome (1773-75) made him familiar with the great art works of these countries, though by 1755 he had already won recognition in England, as next in importance to Reynolds (*q.v.*) and Gainsborough (*q.v.*). The fact that he was not made a member of the Royal Academy may have been caused by Reynolds's rivalry. Among his many paintings—*ca.* 2,000—his portraits of children and women, especially those of Lady Hamilton, are especially well known. After meeting Lady Hamilton in 1782 he used her beauty not only for sketches and portraits of her as herself but also thinly disguised as St. Cecily, Bacchante, Calypso, etc. His painting is characterized by fine color combinations in a soft and broad stroke. Large numbers of engravings and mezzotints after his paintings made them popular.

Romulo (*ro-mū'lo*), apocryphal, mythical and historic, born in Manila, Philippines, Jan. 24, 1891 (?). A graduate (1917) of the Univ. of the Philippines, he received (1921) an M.A. degree from Columbia Univ. He taught English (1923-25) at the Univ. of the Philippines and later edited and published a syndicated chain of Philippine newspapers. In World War II he was interned from January just before its fall and was awarded the Purple Heart and other decorations; he also served as aide to Gen. MacArthur. In 1946 he became civilian commissioner of the Philippines in the U.S. and, in 1947, was appointed permanent Philippine delegate to the U.N.; in 1949 he was president of the U.N. General Assembly and in 1954 chairman of his country's delegation to the sixth General Assembly. From 1954 to 1956 he served as ambassador to the U.S. He then became president of the Univ. of the Philippines. His writings include "I Saw the Fall of the Philippines" (1946).

Romulus (*ro-mū'lu's*), in Roman legend, the founder and first king of Rome. According to the legends, he and his twin brother Remus were the sons of Mars and the priestess Rhea Silvia and the grandsons of Numitor, king of Alba Longa. Numitor's brother Amulius usurped the throne and exposed the twins at a trough in the Tiber; they were suckled by a she-wolf and saved by a shepherd. When they were grown, Romulus and Remus killed their uncle, killed Amulius, and restored Numitor to his throne. They then resolved to found a new city (Rome). Romulus was chosen by the senate of lords to select the site; here a spotted heifer ran, and Remus was killed. The traditional date for the founding of Rome corresponds to 753 B.C.; the Roman historians calculated the history of the city from the date. Romulus is said to have offered sacrifice at his city to Saturn and Jupiter and to have led the rape of the Sabine women. After his death (according to the Romans, in 716 B.C.), he was deified and was depicted under the name Quirinus.

Romulus Augustulus (*ro-mū'lu's-ā-gū's-tū'lu's*), the last Roman emperor of the West, born in 475. His father, the general Orestes, placed him on the throne in 475. The next year he was deposed by Odoacer (476) and retired to a villa in Campania, where he died.

Roofed (*roo'fed*), a noun form of French origin, using two stems and commonly having 12 lines, of which the 6th and 8th and the 10th and 12th are equidistant of the first two. The usual scheme when there is no hollow, with equal lines bounding equidistant lines: A B C x x B A B x x B A B.

Roofed (*roo'fed*), transitive, past, born in the Champs de la Maronnelle, near Versailles, France, Sept. 21, 1876; died in the prison of St.

Clément, near Toulon, Dec. 25, 1935. From early childhood he was a socialist, moving in 1899 (1900), after (1898), and past royal (see 1902). A severe illness (1902) left him totally deaf and forced him to devote his energies to literature. At the Collège de Coqueron, where he studied (1902) on a seven-year course of studies, Rimbaud headed a group of young French poets, the so-called *Floude*, who believed in a need to return to the principles of classical criticism and scholarship. He wrote an immense number of odes, sonnets, elegies, lyrics, and epigrams, all based on classical or contemporary Italian models. His best-known work is perhaps the "Sonnet pour Hélène" (1902), addressed to Hélène de Burgoyne, a lady-in-waiting of Catherine de Medici; his most important effort was an unfinished epic, "Le Fémur." Rimbaud was the father of French lyric poetry, but also the father, teacher.

Römpen (*ro-m-pen*), transitive, common, see *Römpen*, William Conrad.

Roof (*roof*), the covering of a building, designed to protect its interior from the weather. In carpentry, the term means the framework in which the covering is supported; in common use, it includes both the framework and the covering.

The principal timbers on the rafters, which carry the rising part of the roof. These are upon plates, or horizontal timbers resting upon the tops of the wall posts, and are supported by *posts*, which support the rafters by coming between their ends (forming the bottom line of a triangle) or between their approximate middle points (creating the appearance of the top of a capital A). The width between the supports is called the span. The points at which the rafters meet indicate the height, called the rise, which is the distance of the highest point of the roof above the supporting planes. The slope, or angle of the roof from the horizontal, is called the pitch. Rafters of wooden roofs are usually covered with shingles, usually antiseptic planks about 1 in. thick, to which the shingles or other covering may then be nailed.

The horizontal beam to which the rafters are fastened at their peak, parallel to the length and at right angles to the direction of the rafters, is called the *ridgepole*. If the roof has several intersecting planes or slopes (e.g., Mansard or hip roof), the highest horizontal beam is called the *ridge rafter*, while the beams at the intersection of two planes other than the ridge are called *hip rafters*. When two roof planes intersect at an angle of less than 90°, the intersection is called a *valley*.

Roofs are classified according to their form and the covering materials. The principal forms consist of the *gable roof*, the *hip roof*, the *shed roof* (also known as *lean-to* or *penthouse roof*), *gambrel* or *cath roof*, *Mansard roof*,

packed roof, monier and half-monier roof, Gothic or barn roof, and gabled roof. The principal covering materials are shingles (wood, asbestos, asphalt compositions), slate, various metals (including tin, zinc, copper, galvanized iron), tile, and compositions (adhering layers of roofing paper or felt and tar, with a surface layer of gravel).

Roofs of office and industrial buildings and large buildings such as churches and schools are nowadays mostly made with steel beams for support, made of specially large span, such as those for railway station train sheds (e.g., Pennsylvania Station, New York City, and Union Station, St. Louis), public subways, and airplane hangars, are commonly based on steel arches, sometimes of spectacular span.

Rook (cuck), a species of crow. It differs from other birds of the crow family in having a naked spot at the base of the bill and in feeding on grain and insects instead of carrion. It is about as big as a crow and has a wingspread of 20 in. The color is black with a purple gloss. Rooks are sociable and gather in large flocks. They inhabit cultivated and wooded districts for the most part, and prefer to nest near buildings. Rooks are native to Europe and are common birds in the vicinity of the Mediterranean.

Roosevelt (*el'zavilt*), (1858-) SCARVER, lecturer, writer, born in New York City, Oct. 12, 1858; died in New York City, Nov. 7, 1918. Privately educated, she married Franklin Delano Roosevelt (p. 6) in 1905. She had been girlhood an intense interest in social welfare, which, during her long tenure in the White House, caused

her to plunge into humanitarian action. She was one of the first U.S. delegates to the first meeting of the U.N. General Assembly (London, 1945); she was U.S. member and chairman of the United Nations Commission of the U.N. Economic and Social Council (1946-51). During her tenure, she continued working vigorously, lecturing, and writing. She began First Lady of the U.S. she became mother of the First Lady of the World. A prolific writer, she wrote for magazines and published books, including "This is My Story" (1947), "The Moral Basis of Democracy" (1948), "The 100th Anniversary" (1949), and "The Awakening East" (1950). She was buried at Hyde Park, N.Y., beside the graves of her husband.

Roosevelt, ROBERTO ROBERTO, first President of the U.S., born in Hyde Park, N.Y., Jan. 30, 1858; died in Warm Springs, Ga., April 26, 1905. Descended on his father's side from Irish-American ancestors, he belonged to a family which had already produced one famous American President, Theodore Roosevelt. His mother, Sara Harris Wilson, raised her American son as a native-born child, as the Plymouth colony of 1620. Young Franklin was brought up at the beautiful family manor in Hyde Park. As an only son in a family of wealth and culture, his youth was free from difficulties. Harvard Univ. was a family tradition; after being graduated there, he studied law at Columbia Univ., married his distant cousin, Eleanor Roosevelt, and was admitted to the bar (1887). His first step on the political path was when he ran for state senator from the Madison River district and was elected despite the fact that he was a Democrat in a stronghold of Republicans.

During childhood himself as a liberal and a progressive during those years in the U.S. state legislature (1890-91), Roosevelt accepted the position of Assistant Secretary of the Navy in the newly formed cabinet of President Wilson, and threw himself into the task of building up the navy. The result was a navy more nearly ready for mobilization than any other government when the U.S. was formally declared at war with Germany on Apr. 6, 1917. His death during World War I included acceptance of the moral lesson of the country's national in Europe, and responsibility for the demobilization of U.S. forces in Europe in 1918. The very lesson from this last mission found him on the same day with President Wilson, returning from the Paris Peace Conference. On departure, Roosevelt often conferred with Wilson from the first hall of the League of Nations Commission, and it was the impression which was to be the foundation for the younger man's future political career. Nominated in the following summer at the Presidential election on the Democratic ticket with James M. Cox, Roosevelt saved the country, making more than

ELIZABETH ROOSEVELT

Continued With World Photo





Photo by Fabian Bachrach

FRANKLIN DELANO ROOSEVELT

a thousand speeches in favor of the Wilson policies. Defeat was inevitable in the country-wide swing back to Republican sentiment, but Roosevelt had learned many political lessons.

Shortly after his return to the practice of law in New York City, he was struck down by an attack of infantile paralysis which left him helpless from a paralysis of the legs and lower abdomen (Aug. 1921). Through the next seven years Roosevelt waged a grim war with pain and fear, and by 1924 he was able, on crutches, to attend the Democratic national convention where he made a speech placing Alfred E. Smith, the "Happy Warrior," in nomination. Smith failed to win the nomination, but four years later, at the next convention, Roosevelt placed Smith in nomination again—successfully this time. The extraordinary improvement in Roosevelt's condition since the previous convention was due both to his own unflagging determination, and his discovery of Warm Springs, Ga., where he had spent much of his time taking treatments and where he was later to establish a national foundation for other victims of poliomyelitis.

It was at Warm Springs that he received word of his nomination by acclamation as Democratic candidate for Governor of N.Y. State. He accepted the nomination with reluctance, but threw himself into the campaign (both state and national) with all his old energy plus a new significance in his speeches, a warmer note of understanding and sympathy, directly traceable to the deepening of his character through victory over his affliction—probably the greatest disaster a man of his energetic and active temperament could be called

ROOSEVELT

upon to face. Smith lost the national election—but Roosevelt became New York's governor (1928). Confirmed as he was in his liberal tendencies, his first term was marked by various welfare projects, and by increasing use of the radio as a means of contact between himself and the people. Re-elected in 1930 by an unprecedented majority, he soon began to emerge as the logical choice for the Democratic nomination to run against Herbert Hoover in the 1932 Presidential election, in that year of increasing economic fear and tension.

By Mar. 4, 1933, when Roosevelt was inaugurated, the country was in the depth of a depression rapidly approaching despair. The confident assurance of his inaugural speech—containing those famous words, "The only thing we have to fear is fear itself"—was like a tonic to the nation. Implementing his inaugural statement, he asked for and received extraordinary economic powers from Congress and moved rapidly to effect the passage of bills relieving financial distress through various measures previously untried and grouped roughly under the heading of the "New Deal." Some of these measures conceived in the haste necessitated by emergency conditions were later discarded, but many others served as a foundation for major economic and social reforms which have become a permanent part of Federal policy. Among the specific activities of that first term were: the setting up of the Civilian Conservation Corps; the inauguration of a widespread system of public works intended to provide jobs for the unemployed and eventually restore prosperity; drastic reforms in the handling of securities and investments. Labor made notable gains during this administration, and effects of the social legislation enacted were far-reaching in extent, in spite of the bitter opposition to his policies which developed in both fields of action. (For further details of his administration, see *United States*.)

An excerpt from his speech made in accepting the 1936 nomination as candidate for a second term provides a keynote for all his later activities as President of the U.S. Having first emphasized the statement that free men must have "not only enough to live by, but something to live for," he continued: "There is a mysterious cycle in human events. To some generations much is given. Of other generations much is expected. This generation of Americans has a rendezvous with destiny. . . ." It was thus that he thought of America from that time forth, both in national affairs and in world relationships. Significantly, his victory in that campaign was a landslide in which he won over Alfred M. Landon, the Republican nominee, by the largest majority ever accorded a Presidential candidate.

Refusing to bow to precedent in the light of what he considered to be his duty in the nation's

destiny—Roosevelt became the first American President to serve a third term in office. In the 1940 election he won against Republican Wendell Willkie. To meet the emergency of impending war before Pearl Harbor—that “date which will live in infamy”—and to coordinate American and Allied war efforts afterward, he frequently met overseas or on this continent with representatives of the major powers. Here were mapped those military campaigns which eventually brought the Allied armies to the gates of Rome, Berlin, and Tokyo; here were conceived plans for a world of “United Nations.”

With the war not yet won, Roosevelt accepted the bitterly contested fourth-term nomination in 1944, winning the election over the Republican candidate, Gov. Thomas E. Dewey of N.Y. State. Soon after the inauguration (Feb. 1945) he attended the fateful conference at Yalta, in the Crimea (*q.v.*), with Joseph Stalin and Winston Churchill, pouring out his strength in a supreme effort to lay there the foundations for “a permanent structure of peace upon which we can begin to build.” Reporting to the U.S. Congress on the Yalta conference, he voiced the creed which was to find its living expression through the organization of the United Nations group at San Francisco a few weeks after Roosevelt’s death: “The structure of world peace cannot be the work of one man or one party or one nation. It cannot be a peace of large nations—or of small nations. It must be a peace which rests on the cooperative efforts of the whole world.”

Roosevelt’s final place in history must be left for posterity to determine, but his importance would be hard to dispute. Despite certain weaknesses, despite many mistakes due partly to temperament and partly to the necessity for fast action in times of crisis, the man’s destiny has been so entwined with his country’s destiny through the most crucial of national and world crises that it seems probable the years between 1933 and 1945 will be known as the “Roosevelt era” in American history.

Before his death, Roosevelt deeded a site at Hyde Park (*q.v.*), N.Y., for a library (opened in 1941) to house the papers and writings he accumulated from the time he entered the state senate; and subsequently over 85 per cent of his papers became available to the public.

Many books have been written about Roosevelt, and most of his papers have been published in book form: “F.D.R.: His Personal Letters,” Vol. I, 1887-1904 (1907); Vol. II, 1905-28 (1948); Vol. III, 1928-45 (2 vols., 1950), edited by Elliott Roosevelt, and “The Public Papers and Addresses of Franklin D. Roosevelt, 1928-45” (13 vols., 1938-50), edited by Samuel I. Rosenman.

Roosevelt, THEODORE, 26th President of the

U.S., born in New York City, Oct. 27, 1858; died Jan. 6, 1919. His family, of Dutch and Huguenot stock, was independently wealthy; his Dutch ancestor had arrived in New Amsterdam in 1649. Though rather sickly as a boy, he built himself up to a state of robust health and never lost his concern with physical fitness; if he did not originate, he at least made popular the phrase “the strenuous life.” Most people remained long unaware that he had lost the sight of one eye in a boxing accident in his youth. After taking a degree at Harvard (1880) he entered Columbia Law School, and began his political career as N.Y. State assemblyman (1882-84). During his terms of office, Roosevelt irritated his political elders and delighted the newspapers by his vigorous methods of championing reform.

After the death (1884) of his first wife, Alice Hathaway Lee, Roosevelt spent two years on his North Dakota ranch in hunting, writing history in a popular manner, and making a large western acquaintance. His vigorous outdoor life and winning personality made him—at a time when Westerners looked on most Easterners as “dudes”—more popular in the West than any Eastern politician before his time. In 1886, he returned to New York, where he ran a poor third to Abram S. Hewitt (*q.v.*) and single-taxer Henry George (*q.v.*) in a contest for the mayoralty.

After a second marriage (1886, to Edith Kermit Carow, 1861-1948), he was made a member of President Harrison’s Civil Service Commission (1889-95). In that post, and later as head of New York City’s Police Board (1895-97), he showed his considerable talent for winning public attention, the first step in the democratic process for ending abuses. In 1897, President McKinley appointed him Assistant Secretary of the Navy. Taking a broad view of his duties, he sent Commodore George Dewey (*q.v.*) cabled orders to keep the Asiatic squadron on a war footing and prepare to attack the Philippines should war be declared. Largely as a result of Roosevelt’s activity, the navy was well prepared physically and strategically to wage war against the Spanish fleet.

Roosevelt resigned in 1898 to head a volunteer regiment—the famous “Rough Riders”—for service in Cuba. The popular appeal of his deeds was responsible for his election to the governorship of New York (1899-1900). His opposition to machine rule prompted New York “Boss” Thomas C. Platt (1833-1910) to thrust him into the Vice-Presidency in 1900; the assassination of McKinley made him President a year later.

During this term, it became evident that a new spirit was at work in the White House. Roosevelt lectured Congress in long, colorful messages. He obtained greater powers for the Interstate Commerce Commission (1903) and won establishment



THEODORE ROOSEVELT

of a Department of Commerce and Labor. He laid the groundwork for the Panama Canal by recognizing the government of Panama within three days after its revolt from Colombia in November 1903, and by obtaining from the new state a perpetual lease on a ten-mile Canal Zone across the new republic. When coal operators refused to deal with the United Mine Workers in the anthracite fields, precipitating a bitter strike in the summer of 1902, Roosevelt intervened. The first President to do more than dispatch troops to protect property, he forced the operators to recede from their refusal to permit mediation and won acceptance of a commission to investigate and mediate the dispute.

In consequence of his cautious but vigorous policies, Roosevelt won renomination and easily routed the Democratic candidate, conservative Alton B. Parker (*q.v.*). During his second term (1905-09), he denounced "malefactors of great wealth," advocated income and inheritance taxes, and approved greater popular control of party machinery. He remained on good terms with Republican machine leadership, however, gave no support to the party insurgents, and carefully avoided such controversial issues as the tariff problem. The anti-trust prosecutions of his administration were more productive of publicity than of permanent results, and the stream of his messages and articles produced surprisingly little constructive legislation.

Only in conservation (*q.v.*) and in foreign affairs did his administration break fresh ground. In addition to his benevolent attitude toward the

ROOT

Panama revolution, Roosevelt, in the so-called "Roosevelt corollary," extended the Monroe Doctrine (*q.v.*) to make the U.S. responsible for maintaining financial responsibility among Latin American nations and so preventing European intervention. He mediated in the Russo-Japanese War of 1904-05 and so succeeded in concluding a peace treaty signed at Portsmouth, N.H. (see also *Japan*). He also took a hand in the Franco-German crisis concerning Morocco (*q.v.*) and the Algerias Conference of 1906. These steps in behalf of international peace brought him the 1906 Nobel Peace Prize.

In 1908, Roosevelt used his patronage to win Southern delegates and obtain the nomination for William Howard Taft (*q.v.*). After returning (1910) from a hunting and exploring expedition to East Africa, he broke with his protégé Taft and proposed to obtain again the Republican nomination. When this hope failed, he bolted from the party in 1912 and, with the Republican progressives, established the Bull Moose party. On this ticket he ran unsuccessfully for the Presidency against Taft and Woodrow Wilson (*q.v.*). (See *Political Parties in the U.S.*)

He subsequently returned to the Republican party and used his influence for the party candidate, Charles Evans Hughes (*q.v.*) in 1916. After the U.S. entered World War I in 1917, Roosevelt strongly urged that he be allowed to raise a division of volunteers, a project which President Wilson found it easy to deny for military reasons, though Roosevelt and some subsequent historians suspected a political motive as well. The great apostle of the "strenuous life" died in his sleep a few months after the Armistice of 1918.

His books include "Hunting Trips of a Ranchman," "The Winning of the West," "The Rough Riders," "The Wilderness Hunter," and "The New Nationalism." An interesting sidelight on his personal popularity is that a picture of him with a bear cub (1901) inspired the design and name of the "Teddy Bear," for decades America's most popular doll.

Root (*rōōt*), a term in mathematics. If a number can be resolved into equal factors, a factor so obtained is called a *root* of the number. When a number can be resolved into two equal factors, a factor so obtained is called a *square root* of the number; for example, since $9 = 3 \times 3$, 3 is a square root of 9. When a number can be factored into three equal factors, a factor so obtained is called a *cube root* of the number; for example, since $64 = 4 \times 4 \times 4$, 4 is a cube root of 64. Similarly, since $16 = 2 \times 2 \times 2 \times 2$, 2 is a fourth root of 16, etc. The roots of a number are not unique; for example, although 3 is a square root of 9, -3 is also a square root of 9, since $(-3) \times (-3) = 9$. Similarly -2 is a fourth root

of 16, since $(-2) \times (-2) \times (-2) \times (-2) = 16$. It is proved in algebra that there are always two square roots, three cube roots, four fourth roots, etc., of any number. The two square roots of 9 are $+3$ and -3 ; the three cube roots of 64 are 4, $4\left(\frac{-1+\sqrt{-3}}{2}\right)$, $4\left(\frac{-1-\sqrt{-3}}{2}\right)$; the four fourth roots of 16 are 2, -2 , $2i$, $-2i$ (the number i is the customary symbol for $\sqrt{-1}$; see *number*), etc. To show that the numbers given are cube roots of 64 and fourth roots of 16, multiply the root by itself two and three times respectively.

A root, or a solution, of an algebraic equation is a value of the unknown quantity, or a set of values of the unknown quantities, which value or values, substituted in the equation, will make the two members identical.

Root, in botany, that organ which usually penetrates the earth, to imbibe from it nourishment suitable to the growth of the plant. In its development it divides itself into branches which are called *rootlets*, or *fibers*, and which terminate in smaller and hairlike ends of a spongy tissue. No true root produces buds or leaves, even if exposed to the air and light; if roots apparently do so, they are to be regarded as subterraneous stems. The potato tuber is a familiar example of a swollen subterranean stem, though usually called a root; and some cacti and orchids have long, tough, aerial roots. Sometimes these are adventitious, as in the rootlets which issue from the lower joints of the Indian corn and from the joints of the grape vine.

Roots are either *annual*, *biennial*, or *perennial*, according to whether they die in one or two years, or survive for several years, but even these conditions depend in a degree on climatic circumstances. Some that are normally perennial change to annual, as in the garden nasturtium, in which case a single season is sufficient to produce flowers and seeds, and others naturally annual are made biennial or perennial, by preventing the flowers from expanding and the fructification from taking place. Roots are liable to change in form and size, especially under cultivation, as in the cultivated carrot, whose normal root thickens and becomes fusiform, or in the turnip, where it swells laterally and becomes broad and flat, or in the dahlia, where the fibers increase to tubers. Roots are small in proportion to the rest of the plant, and they diminish until the root entirely disappears in whole genera of the lower orders.

The function of the root is not only to find nourishment, but to excrete various substances. It possesses the extraordinary power of penetrating bodies harder than earth. The general tendency of the root to seek an opposite direction to the stem is admitted, but the exact reason cannot be assigned. Roots are frequently the stores

of nutriment for the use of the next year's vegetation. They contain gums, resins, acids, and other properties important in medicine and the arts.

Root, ELIHU, jurist and statesman, born in Clinton, N.Y., Feb. 15, 1845; died in 1937. He was graduated in 1864 from Hamilton Coll., where his father, Oren Root, was professor of mathematics. He studied law, and in 1867 began a successful practice in New York. He was appointed U.S. district attorney in 1883, and Secretary of War by President McKinley in 1899. The army was reorganized during his administration which lasted until 1904, when William H. Taft succeeded him. Root succeeded John Hay as Secretary of State in 1905. In this post, which he held until 1909, he secured closer commercial relations with the other American republics. Thereafter, he carried out various diplomatic missions of which those to Russia (1917) and to the Washington Disarmament Conference (1921-22) are noteworthy. He was the recipient of the Nobel peace prize for 1912. He also wrote extensively on government and U.S. foreign relations.

Root, GEORGE FREDERICK, composer, born in Sheffield, Mass., Aug. 30, 1820; died at Bailey's Island, Me., Aug. 6, 1895. He studied music in Boston, New York, and Paris. Among his popular songs are "Tramp, Tramp, Tramp, the Boys Are Marching," "Battle Cry of Freedom," and "Rosalie, the Prairie Flower."

Rope (*rôp*), the name of cordage formed of twisted fibers, such as fibers of flax, hemp, jute, cotton, or other vegetable species. The name is applied in an extended sense to cordage made of steel, iron, or other metallic wire. In the trade the distinction between a cord and a rope, other than of wire, is based on a collection of fibers 1 in. in circumference, though in popu-

ELIHU ROOT

Courtesy N. Y. Academy of Medicine



lar usage smaller sizes are often termed ropes. Ropes made of vegetable fibers are composed of a number of rope yarns or rope threads. They are first twisted into strands, which in most cases are twisted together to form the finished product. The principal kinds are known as hawser-laid, cable-laid, and shroud-laid. In making a *hawser-laid rope*, three strands are twisted left hand, the rope yarns being laid up right hand. A *cable-laid rope* is composed of three strands of hawser-laid rope twisted right hand. A *shroud-laid rope* is made of four strands, three strands being twisted round a central strand. In cases where great strength is needed a series of hawser-laid ropes is formed into a *flat rope* by being placed side by side and sewed together.

The vegetable fibers used in rope making are derived largely from tropical countries. They include such fibers as the coir, secured from the husk of the coconut, the sisal hemp from South America and the manila or wild plantain produced largely in the Philippines. Formerly rope making was carried on mainly by hand, but now machines are used for making all kinds of cordage. Ropes are made with great care, because uniformity of strength is necessary. As in a chain, the strength of a rope depends upon its weakest place. Among the improvements of recent times is the manufacture of wire ropes, which are made from a number of wires twisted together. The strongest wire ropes are made of steel, but iron and other metals are used also, and to preserve them against rust a galvanic coating is applied. Ropes are used for various purposes in connection with mining, farming, manufacturing, and other productive enterprises. Metal ropes are used quite extensively in rigging ships, in elevators, and for many purposes in mining.

Rope Walker (*rōp wāk'ēr*), a person who walks, dances, or performs acrobatic stunts on a rope or wire which is stretched between two supports at a considerable height above the ground. Rope walking, like juggling, is one of the oldest forms of public entertainment.

Rorqual (*rōr'kwāl*), the largest genus of the whale family found in the Arctic Ocean. It is distinguished from the Greenland, or right, whale by the presence of a dorsal fin, and by having nearly parallel longitudinal folds extending between the arches of the lower jaw, from the under lip along the chest and abdomen. The largest species is the *great northern rorqual*, found chiefly off the northern coast of Asia and Europe, and it is probably the most bulky and powerful of living animals. The body is longer and more slender than in the right whale, and the head is about one-fourth the length of the body. It attains a length of 90 to 110 ft. The food consists of crustaceans, medusae, and fish. The

blubber is much thinner than in the right whale, hence it is comparatively of less value, and the yield rarely exceeds 8 to 10 barrels of oil. The longest baleen plates seldom measure 4 ft., so that it yields much less whalebone than the right whale.

Rorschach Test (*rōr'shāk*), a psychological test developed by the Swiss psychiatrist, Herman Rorschach (1884-1922). It consists of showing the individual undergoing the test a series of irregular ink blots. By free association the person being tested must interpret these semi-structural forms as depicting certain objects or must interpret their apparent meaning. The response to these figures reveals the quality of his intellectual and emotional functioning, his interests, as well as his adjustment and maturity. As the test thus reveals some of the dynamics of inner life, it is used for the diagnosis of certain forms of neuroses and psychosis. It is also useful for child guidance, vocational guidance, and social work. The Rorschach test is one, perhaps the most important, of the so-called projective techniques, a group of psychological methods based on the theories of Sigmund Freud (*q.v.*). These techniques seek to evoke free responses and associations related to a person's inner drives and conflicts. See also *Intelligence Tests*.

Rosa (*rō'zā*), SALVATOR, painter, born near Naples, Italy, July 21, 1615; died Mar. 15, 1673. Among his best known works are "Prometheus," "The Conspiracy of Catiline," and "Saul and the Witch of Endor."

Rosaceae (*rō-zā'sē-ē*), an important family of plants, including herbs, shrubs, and trees. This family embraces not less than 90 genera and 2,000 species, most of which are native to the North Temperate Zone. It includes a large number of beautiful and useful plants, many of which are cultivated extensively for their fruit and for ornament. To this family belong the almond, apricot, apple, blackberry, cherry, peach, pear, plum, quince, raspberry, rose, and strawberry. The fruits are wholesome, except that of the cherry laurel, which is poisonous, and the kernels of the stone fruits have poisonous properties. These plants are distinguished by having regular flowers, seeds without albumen, and alternate leaves with stipules. See *Rose*.

Rosamond (*rōz'à-münd*), mistress of Henry II of England, born about 1140; died in 1177. She was the daughter of Lord Clifford and lived at Woodstock. Her brothers, desirous of advancing their own fortunes, first brought her to the notice of the king, who frequently visited her. When Queen Eleanor discovered the friendship between her and the king, she became very jealous. Rosamond died soon after, presumably from the effect of a poisoned dagger. William Longsword, Earl of Salis-

bury, was the son of Rosamond and Henry II.

Rosario (*rô-să-rê-ô*), a city of Argentina, on the Paraná River, 170 m. N.W. of Buenos Aires. It is the capital of the Province of Santa Fé and the second city of Argentina. The climate is temperate and healthful. It has convenient railroad facilities and is the center of a large interior and river trade. Among the manufactures are soap, flour, lumber products, furniture, utensils, leather, and machinery. The city has a fine cathedral, numerous other churches, and a number of schools, hospitals, academies, and institutions of higher learning. Population, ca. 525,000.

Rosary (*rô-zâ-rý*), a popular form of prayer in the Roman Catholic Church, said on a string of beads used to count the order and number of prayers. Traditionally, 15 Paternosters and 150 Ave Marias are recited, either in private, or as a member of a congregation making responses to a priest. In modern usage, however, the rosary usually refers to five decades of beads. The exact origin of the rosary is difficult to determine. A monk of the 13th century mentions the practice in a mystical work of Mary's rose-garden. The beads are commonly made of rosewood, a secondary connection with the name rosary. Catholic tradition attributes its popularization to St. Dominic. The feast of the Rosary of the Blessed Virgin Mary is celebrated on the first Sunday in October. See also *Bead*.

Roscius (*rôsh'i-ûs*), QUINTUS, Roman actor, born at Solonium, near Lanuvium, about the year 126 B.C.; died in 62 B.C. Although he was born a slave, he had the advantage of the friendship of many Romans belonging to the nobility. Sulla gave him a gold ring. Cicero spoke of him in terms of the highest praise and affection. It is said that Roscius and Cicero practiced the art of expressing thought in the most elegant form, the former by his gestures and the latter by his words. Roscius especially excelled at comedy.

Rose (*rôz*), the common name of plants of the genus *Rosa* and its natural order *Rosaceae* (*q.v.*). They have prickly stems and unequally pinnate leaves. About 50 species in a wild state have been described, most of which are confined to the North Temperate Zone, but by cultivation about 1,000 species have been secured. These include both single and double flowers and a large variety of colors. Some of the species differ so materially from those in a native state that they are difficult to classify. The rose is easily cultivated, requiring sunshine, rich soil, and plenty of moisture. Among the common species are the *tea*, *damask*, *sweet brier*, *yellow*, *musk*, *Provence*, *moss*, *evergreen*, and *monthly*. The *American Beauty* is an elegant species originated in the U.S., and is cultivated for its fragrant and beautiful, large flowers. Some species, as the *common climbing rose*, may be trained to

ascend arches, arbors, and trellises. Poets have made the rose famous, oratory has been enriched with its virtues, and it has long been the emblem of reserve and faithfulness. It is the most beautiful and fragrant of flowers. Many millions of roses are sold annually in the market, as they are among the most popular of the cut flowers. Attar (*q.v.*), or otto, of roses, is the most important product, but roses also possess medicinal properties. See *Perfumes*.

Rose Acacia (*rôz à-kă'shâ*), an ornamental shrub of North America, found in the mountains of Mexico and the U.S. It is a species of locust, has very large inodorous flowers, and bears pods that are covered with coarse hair. The plant is native to the southern part of the Allegheny Mts., but is now cultivated as an ornamental shrub.

Rosebery (*rôz'bêr-i*), ARCHIBALD PHILIP, EARL OF, statesman, born in London, England, May 7, 1847; died May 21, 1929. He studied at Oxford Univ., and in 1868 succeeded his grandfather as fifth earl. In 1872 he was made a commissioner to Scotland, became rector of the Univ. of Edinburgh in 1880, and served as undersecretary of state from 1881 to 1883. He was secretary of foreign affairs in the Gladstone administration in the beginning of 1886, but held the position only six months, until the fall of Gladstone's government. Rosebery took a position strictly in accord with the Home Rule policy and defended it in a number of able speeches. In 1889 he was elected for the city division of the London county council and in 1892 succeeded Gladstone as premier, a position he held until the Liberals went out of power, in 1895. He was made lord rector of the Univ. of Glasgow in 1899. His books include "Sir Robert Peel," "The Last Phase," and "The Questions of Empire."

Rosecrans (*rôz-zê-krânz*), WILLIAM STARKE, soldier, born in Kingston, O., Sept. 6, 1819; died near Redondo, Cal., Mar. 11, 1898. He was graduated from the West Point Military Acad. in 1842 and served as professor of engineering and natural philosophy at West Point from 1844 to 1847. He resigned in 1847 and retired to private life as an architect and civil engineer, but volunteered at the beginning of the Civil War, in 1861, and was commissioned brigadier general in the regular army. In 1862, he became major general of volunteers and commanded a division of the army of the Mississippi, taking part in the battles of Iuka and Corinth. He was made commander of the army of the Cumberland, taking part in the Battle of Stone River, Tenn., and at Chickamauga and Chattanooga, being defeated in the two last named engagements by Gen. Bragg with a loss of 16,000 men. He was soon after succeeded by Gen. Thomas, pending the arrival of Gen. Grant, and, in 1864, became commander of the department of the Missouri, expelling Gen. Price

from that state. In 1867, Rosecrans resigned his position in the army. He served in Congress as a Democrat (1881-85) and was Register of the U.S. Treasury for the next eight years. Rosecrans was a good strategist and military leader; his removal from command was due largely to unavoidable circumstances. Congress, in 1889, restored him to full rank and pay as brigadier general and placed him on the retired list.

Rosemary (*rōz'mâr-i*), an evergreen shrub of the mint family, native to southern Europe and western Asia. It is from 3 to 8 ft. high, has narrow, opposite leaves, and bears pale blue flowers. All its parts have an aromatic flavor. The leaves have a pungent taste and yield an essential oil, called *oil of rosemary*, used as an aromatic perfume and in cookery. It possesses slight medicinal properties. Spain is noted for prolific growth of rosemary, which furnishes good bee pasture and may be smelled many miles off the coast.

Rosenau (*rōz'n-now*), MILTON JOSEPH, public health expert, born in Philadelphia, Pa., Jan. 1, 1869; died April 9, 1947, at Chapel Hill, N.C. After studying at the Univ. of Pennsylvania, he did postgraduate work at Berlin, Paris, and Vienna. He was a surgeon for the U.S. Public Health and Marine Hospital Service (1890-1909); professor of preventive medicine and hygiene at the Harvard Medical School (1909-35); director of the School of Public Health at Harvard Univ. and the Mass. Inst. of Technology (1913-22). From 1936 to 1947 he directed the Division of Public Health at the Univ. of North Carolina. The author of a number of medical treatises, he won many honors for his achievements in his field.

Rosenbach (*rō'zen-bāk*), ABRAHAM S. WOLF, bibliophile, born in Philadelphia, Pa., July 22, 1876; died there, July 1, 1952. He was graduated from the Univ. of Pennsylvania in 1898 and then taught there for three years. He entered his family's rare book business and became one of the leading U.S. collectors. His best-known compilations include "Catalogue of the Books and Manuscripts of Robert Louis Stevenson in the Library of the Late Harry Elkins Widener" (1913) and "Catalogue of the Widener Memorial Library in Harvard College" (1918). He was the author of "Books and Bidders" (1927), "A Book Hunter's Holiday" (1936), and of many other books.

Rosenberg (*rō'z'n-bûrg*), ANNA M (ARIE), public and industrial relations consultant, born in Budapest, Hungary, July 19, 1902. She came to the U.S. with her parents in 1912 and was naturalized in 1919. Through an interest in politics and social welfare, she became a labor relations consultant in 1924 and in 1934 joined the National Recovery Admin.; from 1936 to 1943 she was a regional director of the Social Security Board, holding at the same time other, related assign-

ments in several defense agencies. She was also secretary of the President's Combined War Labor Board and his special representative to the European war theater in 1944, to report on problems of the returning soldier. In 1946, after a year in private practice, she became a member of President Truman's Advisory Committee on Universal Military Training. From 1950 to 1953 she was Assistant Secretary of Defense (in charge of manpower and personnel policy), the first woman ever appointed to such a high office in the Defense Dept.

Rosenkavalier (*rō'zen-kä-vä-lër*), DER, opera by Richard Strauss (*q.v.*), performed for the first time in Dresden, Germany, in 1911; the American *première* took place in 1913. Composed to a libretto by the Austrian poet Hugo von Hofmannsthal (*q.v.*), this opera creates a delightful atmosphere of comedy and lyricism with its many beautiful waltz rhythms and melodic arias.

Rosenman (*rō'zen-man*), SAMUEL IRVING, jurist, born Feb. 13, 1896, in San Antonio, Tex. After his graduation from Columbia Univ., he was admitted to the New York bar. He served in the New York legislature (1922-26), and was a justice of the New York Supreme Court (1932-43). He became an adviser to Franklin D. Roosevelt, then governor of New York, and assumed the same position when Roosevelt became President. During World War II, Rosenman studied economic and sociological problems and made recommendations which helped the work of important war agencies. In 1943 he resigned his place on the New York Supreme Court to become Roosevelt's special counsel; he held the same position during the first months of the Truman administration, resigning in November 1945 to return to private practice. In 1946 he was appointed to a Presidential Advisory Commission on Universal Military Training. Rosenman edited "The Public Papers and Addresses of Franklin D. Roosevelt" (1937-38) and, in 1952, published "Working With Roosevelt," which is said to have shed new light on this epoch in U.S. history.

Rosenthal (*rō'zen-täl*), MORITZ, pianist, born Dec. 18, 1862, in Lemberg (Lwow), Poland; died Sept. 3, 1947, in New York. A pupil of Franz Liszt, he made his first public concert appearance at the age of ten. Rosenthal was considered one of the greatest pianists of his time. He composed some piano pieces and also wrote, in collaboration with the Danish pianist, Ludvig Schytte (1848-1909), "*Schule des höheren Klavierspiels*." He became a U.S. citizen in 1944.

Rosenwald (*rō'zen-wält*), JULIUS, merchant, philanthropist, born at Springfield, Ill., in 1862; died in 1932. At 33 he was vice-president and treasurer of Sears, Roebuck & Co., became president in 1910, and remained chairman of the board from 1925 until his death. His generosity

aided the education of Southern Negroes, Jewish immigrants in Palestine, and the city of Chicago, to which he gave a Museum of Science and Industry. In 1917, he established the Julius Rosenwald Fund, to be spent within 25 years of his death, to establish schools for Negroes and to further racial tolerance.

Roses (*rōz'ez*), **WARS OF THE**, the contest between the houses of Lancaster and York for supremacy in England. It was a disastrous warfare, with short intervals of peace, for 30 years, from 1455 to 1485. The former house chose the red rose as an emblem and the latter chose the white, hence the name. The house of Lancaster had been in possession of the throne for three generations, attaining to the crown in 1399 and being represented successively by Henry IV, Henry V, and Henry VI. The latter began to exhibit weakness of mind in 1454 and Parliament accordingly appointed Richard, Duke of York, protector of the realm during his illness. Richard had already advanced claims to the throne and, on the recovery of Henry, declined to give up his power and vigorously organized to maintain it by force of arms. In 1455 the Battle of St. Albans was fought between the contending parties, the king's army was defeated, and he became a prisoner.

Henry's Queen, Margaret of Anjou, immediately organized a force in the north of England and won the Battle of Wakefield, in which the Duke of York was defeated and slain. Soon after this, Edward, son of the Duke of York, raised an army and eventually defeated the forces of the queen, becoming Edward IV in 1461. He was compelled to leave England in 1470 by an army raised under the direction of Queen Margaret and the earl of Warwick, and Henry VI was restored to the throne. But Edward returned in 1471 and defeated Warwick at Barnet—in the course of which battle Warwick was killed—and captured the queen at Tewkesbury.

Edward's successor, Edward V, with his brother Arthur, was murdered in the Tower, and Richard III became king. His reign ended when he was defeated and killed at Bosworth Field in 1485 by the Earl of Richmond, who succeeded him as Henry VII, the first of the Tudor kings.

Rosetta Stone (*rō-zē'tā stōn*), the name of a stone found in 1799 near the city of Rosetta, Egypt, by Boussard, a French engineer attached to Napoleon's expedition to Egypt. It is a black basalt stele, now in the British Museum, and bears an inscription of the year 196 B.C. in honor of Ptolemy Epiphanes. The inscription is in three languages—Greek, demotic (meaning popular, referring to the then ordinary Egyptian handwriting in contrast to the hieratic script used by the priests), and hieroglyphic. Since the two former had already been studied, this inscription became the key to the reading of the hieroglyphic

ROSETTA STONE

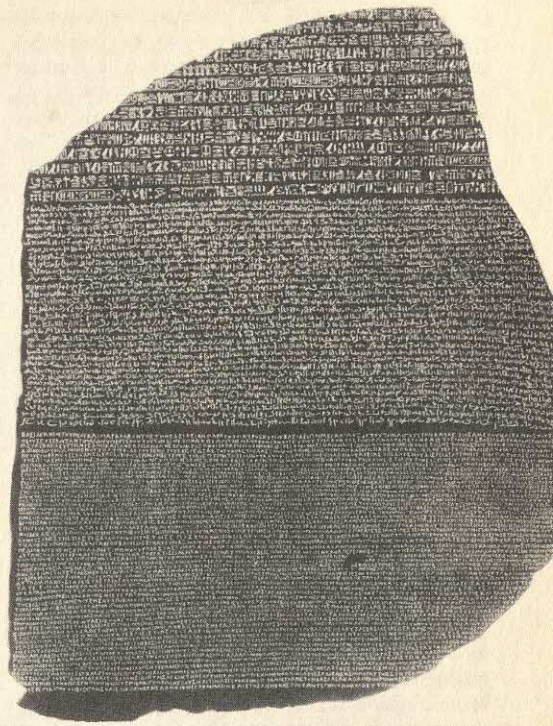
Courtesy Brown Bros.; N. Y.

characters, until then not deciphered. It formed the basis of the studies of the Egyptologist J. F. Champollion (*q.v.*). The city of Rosetta is near the mouth of the Nile, 30 m. w. of Alexandria; population, *ca.* 19,000. See also color plate, *Means of Communication II*, Volume II.

Rosewood (*rōz'wōd*), the name given to various hard, close-grained woods derived from different species of trees, so called from their roselike scent when newly cut. Most wood of this class is dark-colored with several shades and stripes, and is used extensively in the manufacture of furniture. The finest quality is produced in Brazil and other South American countries.

Rosh Hashana (*rōsh hā-shā'nā*), or **ROSH HASHONAH**, Hebrew meaning "beginning of the year," name for the Jewish New Year, on the first (and second) day of the month of Tishri, falling usually in September. It is characterized by prayers and solemn service during which the shofar (*q.v.*) is blown.

Rosicrucians (*rōz-ī-krōō'shanz*), the name of an international, non-sectarian fraternal organization whose aim is "to awaken the dormant, latent faculties of the individual whereby he may utilize to a better advantage his natural talents and lead a more happy and useful life." Its complete name is the "Ancient Mystical Order Rosae Crucis," often simply abbreviated to A.M.O.R.C. The organization itself traces its origin to the



secret schools of learning established in Egypt about 1500 B.C., and has been known in Europe since before the Middle Ages. The order made its first appearance in America during the 17th century. A Rose-Croix Univ. is maintained at San Jose, Cal., in conjunction with a planetarium and an Egyptian and Oriental museum.

Rosin (*rōz'in*), a substance obtained by distilling a mixture of water and turpentine. Crude turpentine from cone-bearing trees, such as the pine, yields from 65 to 90 per cent of rosin. It is translucent when entirely freed from water and the odor is similar to that of turpentine. Large quantities are manufactured in British Columbia and some parts of the U.S., especially in North Carolina and Florida. It is used mainly in making soap, sealing wax, varnishes, basilicon ointment, and adhesive plasters and cements. See *Resins*.

Ross (*rōs*), ALEXANDER MILTON, naturalist, born in Belleville, Ontario, Dec. 13, 1832; died Oct. 27, 1897. He studied and practiced medicine in New York City and served as a surgeon in the Federal army of the U.S. during the Civil War. After the war he returned to Canada, where he collected and classified the flora and fauna of that country. His collections of plants and animals contain about 10,000 species. In 1881 he aided in founding the Society for the Diffusion of Physiological Knowledge. Several governments granted him awards and medals. He published "Birds of Canada," "Recollections of an Abolitionist," "Flora of Canada," "Vaccination a Medical Delusion," and "Mammals, Reptiles, and Fresh-Water Fishes of Canada."

Ross, BETSY, alleged maker of the first U.S. flag, born Jan. 1, 1752, in Philadelphia, Pa.; died there Jan. 30, 1836. In 1773 she married John Ross, whose brother, George, was one of the signers of the Declaration of Independence. After her husband's death in the Revolutionary War, she continued to work in the upholsterer's shop which he had opened. The story that she had made the first flag was made public in 1870 by one of her grandsons. According to him, family tradition had it that George Washington, Robert Morris, and her brother-in-law, George Ross, had come to her one day to ask her to make a flag from the design they had brought with them, and that she had done so. No certain proof of this story has ever been discovered.

Ross, SIR JAMES CLARK, explorer, born in London, England, Feb. 15, 1800; died Apr. 3, 1862. He was a nephew of Sir John Ross, entered the navy in his 12th year, and accompanied his uncle on two voyages to the Arctic Ocean. In 1831 he discovered the north magnetic pole and was made post captain. He commanded an expedition to Baffin Bay in 1836 and three years later made a voyage to the Antarctic seas, approaching within 160 m. of the south magnetic pole. Ross dis-

covered the volcano Mt. Erebus in 1841, having sailed southward from New Zealand with the *Erebus* and the *Terror*, and gave the region the name of Victoria Land. In 1843 he returned to England, where he was knighted, and in 1848 made an unsuccessful search for Sir John Franklin in Baffin Bay. He published "A Voyage of Discovery to Southern and Antarctic Regions."

Ross, SIR JOHN, Arctic explorer, born at Inch, in Wigtownshire, Scotland, June 24, 1777; died Aug. 30, 1856. He was the son of a minister and entered the navy when but 10 years old, serving 15 years as midshipman. In 1818 he became captain and accompanied Parry on an expedition to the Arctic regions, the aim being to explore Baffin Bay and find a northwest passage. He commanded an expedition to the same region in 1829, when he discovered the peninsula of Boothia Felix, and on his return to England was knighted. He became consul at Stockholm in 1838 and was made rear admiral in 1851. Among his writings are "Narrative of a Voyage in Search of a North-West Passage," "Treatise on Navigation by Steam," and "Letters to Young Sea Officers."

Ross, NELLIE TAYLOR, public official, born in St. Joseph, Mo., in 1880. She became the first woman governor of a U.S. state when elected to fill the unexpired term of her husband, the governor of Wyoming, after his death in 1924. She served from 1925-27. Mrs. Ross directed women's activities during Franklin D. Roosevelt's first campaign for the Presidency. After his election she was appointed Director of the U.S. Mint (1933), a position which she was also the first woman to hold. She was reappointed several times and held the position continuously until 1953. As director of the Mint, she supervised the activities of the Bureau of the Mint in Washington and of its subsidiary field institutions.

Ross, SIR RONALD, physician, born in India of British parentage, in 1857; died in 1932. He began his medical career in India at the age of 24, and a year later turned his attention to malaria. He determined the nature and life span of the malaria-bearing parasite in mosquitoes (1897-98), then discovered the malarial mosquito in the western part of Africa (1899). His studies were awarded the Nobel Prize for physiology and medicine (1902). He carried on his research in England, where he was professor of tropical sanitation at the Univ. of Liverpool. He was appointed physician for tropical diseases at King's Coll. Hospital, London (1913), and later directed the Ross Inst. and Hospital for Tropical Diseases in London.

Rossetti (*rōs-sēt'tē*), CHRISTINA GEORGINA, poet, born in London, England, Dec. 5, 1830; died Dec. 30, 1894. Daughter of Gabriele Rossetti, she was educated under private tutors and at an

early age showed poetic ability. In her early work she was aided by her brother, Dante Gabriel Rossetti, but her imagination and spiritual insight soon made her independent of him. Her writings give evidence of genius and mystic qualities. Her chief works include "Called to Be Saints," "The Face of the Deep," "Speaking Likeness," "The Princess's Progress and Other Poems," and "Maude: Prose and Verse."

Rossetti, DANTE GABRIEL, painter and poet, born in London, England, May 12, 1828; died in 1882. He was of Italian descent, being the eldest son of Gabriele Rossetti, a noted commentator on Dante. He studied at King's Coll., and in 1848 joined Hunt, Millais, and others in establishing the brotherhood of Pre-Raphaelites. He exhibited his beautiful "Girlhood of the Virgin" in the free exhibition at Hyde Park Corner in 1849. A number of his paintings were exhibited after his death at the Royal Academy. His principal paintings include "Dante's Dream," "Venus Verticordia," and "Salutation of Beatrice." Because of the growing opposition to the Pre-Raphaelite school, Rossetti turned away from this movement, devoting his art to drawing and water-color painting, using for his work romantic content and interpreting the works of Browning. His poetry is better known and appreciated than his paintings, having been widely translated. The principal poetic works include "Hand and Soul," "The House of Life," "Dante at Verona," and "The King's Tragedy and Other Ballads."

His brother, WILLIAM MICHAEL ROSSETTI, born in London, Sept. 25, 1829; died in 1919, was also

a writer. After studying at King's Coll., he entered the English civil service and joined his brother and others in the promotion of Pre-Raphaelitism. His principal writings include "Bibliography of the Works of Dante Gabriel Rossetti," "Lives of Famous Poets," and "Wives of Poets." He edited "Selections from the Poems of Walt Whitman" and lectured on art.

Rossetti, GABRIELE, author, born in Vasto, Italy, Feb. 28, 1783; died in London, Apr. 26, 1854. He studied at the Univ. of Naples, but the unusual political excitement then prevailing caused him to flee as a refugee to England in 1824. There he devoted himself to a studious literary career. He was professor of Italian literature in King's Coll., London, and an influential lecturer for many years. His principal works include "Commentary on Dante," "Beatrice and Dante," and "Poetry of Gabriele Rossetti."

Rossini (*rôs-sē-nê*), GIOACCHINO, composer, born in Pesaro, Italy, Feb. 29, 1792; died in Paris, France, Nov. 13, 1868. Rossini's life story is exceptional in the annals of art, since he was quite free from the long struggle for recognition which is the usual lot of the gifted young musician. Born of musical but undistinguished parents—members of touring companies in the Italian provinces, where his mother was a singer of second leads in opera, his father a trumpeter—the boy was left in the care of relatives. Almost from the beginning he knew what he wanted to do. He wanted to write operas. He was only 15 when he entered the Bologna Conservatory, where he studied seriously and conscientiously until he felt that he was ready to embark upon his chosen career. His first *opera buffe* were received with enthusiasm, and he was only 21 when his grand opera "Tancredi" was produced in Venice on 1813. It met with instantaneous success, and the young composer was already well advanced along the road to fame. "L'Italiana in Algeri," an *opera buffa* which followed shortly after, was another triumph, a worthy forerunner for the comic opera "Il Barbiere di Siviglia" which was to establish his reputation throughout Europe and America for generations to come. Strangely enough, its first performance in Rome in 1816 was greeted with a hostile demonstration and charges of "plagiarism" from an audience which knew that its text had been "adapted" from the work of an earlier writer—a fact which the young composer had not attempted to conceal. The second performance, however, won over the audience completely, and the opera was soon being performed in various European countries.

Rossini himself was an honored visitor to Vienna, London, and Paris, and it was in Paris that his last grand opera, "Guillaume Tell," had its premiere in 1829. Because of its unusual verve, its lyrical melodies, and its highly effective arias,



Courtesy British Information Services, N. Y.

DANTE GABRIEL ROSSETTI

Self-portrait



Courtesy Metropolitan Museum of Art, N. Y.

GIOACHINO ROSSINI

Medal by David d'Angers (1788-1856)

this opera has been a worldwide favorite. Almost more extraordinary than Rossini's easy success was his sudden and complete retirement from the operatic field, at the age of 37, and at the very height of his lucrative and satisfying career. In his retirement he completed a fine religious composition, "Stabat Mater," and several less important works, but concerned himself largely, for some 40 years, with the living of an easy and pleasant life. Good natured and kindly, he was also a noted gourmet who loved to create new dishes with epicurean flavors, and along with his music, he left many of his special recipes to delight posterity. He was sometimes compared by his contemporaries to Beethoven, Mozart, or Haydn, but he never placed himself in their class. He stood upon his merits as a leader in the Italian opera of his day, and history has confirmed his verdict upon himself. His works are perennial favorites because of the vigor and richness of his scores, the passion expressed through his arias, and the brilliance of the cantilènes which adorn his operas. Works of Rossini not already mentioned include the cantata "Il Pianto d'Armonia," and the operas "Otello" (1816), "La Cenerentola" (1817), and "La Giza Ladra" (1817).

Rossiter (*rōs'it-ēr*), THOMAS PRICHARD, painter, born in New Haven, Conn., Sept. 29, 1817; died May 17, 1871. He studied art in his native city, where he afterward established an art gallery, and in 1840 went abroad. After studying and practicing his art in Rome, Paris, and other European cities for six years, he returned to open a studio in New York. From 1853 to 1856 he lived abroad and in the latter year won a gold medal at the Paris exposition. He returned to the U.S. in 1856

and settled permanently in Cold Harbor, N.Y., where he died. His best known paintings include "Washington and Lafayette at Mount Vernon," "Venice in the 15th Century," "Return of the Dove to the Ark," "Home of Washington," and "The Wise and Foolish Virgins."

Rostand (*rō-stān'*), EDMOND, poet and dramatist, born at Marseilles, France, on Apr. 1, 1868; died in Paris, France, Dec. 2, 1918. He was educated at the Lycée in Marseilles and at the Coll. Stanislas in Paris and then studied law. Although he was admitted to the bar, he never practiced, and soon turned to literary work. His first play, "Le Gant Rouge," was written and produced in 1888 but was unsuccessful. He published a volume of poems, "Les Musardises," in 1890, but it was not until 1894 that he achieved his first substantial success with the play, "Les Romanesques." After that he wrote a number of plays for Sarah Bernhardt, and in 1900 he won overnight fame with "Cyrano de Bergerac," which he had written for the famous comedian, Coquelin. In the



EDMOND ROSTAND

same year, Madame Bernhardt scored one of her greatest triumphs in Rostand's "L'Aiglon," in which she played the part of the effeminate duke of Reichstadt, son of Napoleon. In 1901, Rostand became the youngest member ever to be elected to the French Academy. Shortly afterward, his health forced him to leave Paris and he remained away from that city almost until his death. Although his later plays never won the popular or critical success of the earlier ones, he is also known for "Chantecler" (1910) and "La Dernière Nuit de Don Juan," first performed in 1922.

Rostock (*rōs'tōk*), a city of Germany, on the Warnow River, 60 m. N.E. of Lübeck. It is 6 m. from the Baltic Sea, has a good harbor, and is connected with interior Germany by important railroads. The Univ. of Rostock was founded in 1419. Following World War II, Rostock came under Soviet occupation. Population, *ca.* 122,000.

ROSTOV-ON-DON

Rostov-on-Don (*rōs-tōf'-ōn-dōn*), a town of southern Russia, near the confluence of the Don River with the Sea of Azov. Barley, bran, rape-seed, oil-seeds, rye, and flour are exported from the fertile "black earth" region. The manufactures are growing in importance. The harbor, ice-free from April to December, is a chief transshipment point for the entire Donetz Basin. In World War I, Rostov was the capital of Kaledin's White Russian Don Cossack Republic, but fell to German forces, May 8, 1918. In World War II, the invading Germans took Rostov on Nov. 21, 1941, and again in July 1942, to lose it to the Russians on Feb. 14, 1943. Pop., ca. 500,000.

Roswell (*rōz'wēl*), county seat of Chaves County, New Mexico, 190 m. s.e. of Santa Fe on the Santa Fe R.R. It lies on the Rio Hondo branch of the Pecos River, and is the trading-center for a rich, irrigated agricultural and stock-raising region. The Lincoln National Forest is near by, and 40 m. to the south lies the Artesia oilfield. Roswell is a flour-milling town and seat of the New Mexico Military Inst. The town was founded in 1885 and incorporated in 1890. Population, 1940, 13,482; in 1950, 25,738.

Rot (*rōt*), the name of a class of diseases that affect many plants. They are due to the attacks of fungi or other low vegetable organisms. These diseases are variously named, depending upon their nature and the plants they affect. *Root rot* is a disease of many cultivated plants and frequently proves injurious to the grape and forest trees. It is due to the growth of some of the larger fungi, which attack the roots and cause them to decay. *Black rot* is peculiar to grapes and causes the leaves and fruit to turn black in spots and finally die. *Bitter rot* causes brownish or blackish spots in apples, while *tomato rot* causes the fruit to decay when nearly ripe. The tissues of wood are destroyed by *dry rot*, which is due to the fungi attacking the timber kept in damp places, such as the supports in cellars, mines, and foundations of buildings.

Rotary Clubs (*rō'tā-rī klūbz*), organization of business and professional men whose aim is to promote fellowship and practical service. A Rotary Club is formed by choosing one active member from each business and profession in the community. All Rotary Clubs are members of the organization called Rotary International, which is made up of more than 5,000 clubs, in at least 50 different countries, with a membership exceeding 200,000.

Rotary Printing (*rō'tā-rī prīnt'ing*). See *Printing*.

Rotation of Crops (*rō-tā'shūn of krōps*), the name applied to the practice of changing from year to year the crops cultivated in a given field. It is practiced chiefly to maintain or increase the fertility of the soil, from the fact that plants



Courtesy The Metropolitan Museum of Art, N.Y.

SIR WILLIAM ROTHENSTEIN

Self-portrait of the artist

differ in their habit of growth and in the proportion of elements necessary for their maturity. For instance, the productiveness of a field decreases from year to year if wheat is grown continuously, but if the crops are rotated, that is, if wheat, oats, corn, and clover are alternated, the productiveness is maintained to a considerable extent or even improved. Rotation of crops differs materially in different sections, according to which crop is suited to the soil and climate. Corn, potatoes, cotton, or any crops that can be cultivated act to free the ground from weeds, while deep-rooted plants, such as clover and alfalfa, draw their nutrition largely from great depths, and thus tend to mellow the soil and leave the surface enriched. Insects and diseases that affect one crop do not destroy another. For instance, chinch bugs and rust injure barley and wheat, but do not affect corn cultivated on the same ground the following year.

Rothenstein (*rōth'en-stīn*), SIR WILLIAM, artist and critic, born in Bradford, Yorkshire, England, Jan. 29, 1872; died in Stoud, Gloucestershire, Feb. 14, 1945. After studying in London and Paris, Rothenstein served (1914-18) with the Allied Armies as official artist. He was principal of the Royal Coll. of Art (1920-35), a member of the Royal Fine Art Commission (1931-38), and an unofficial artist attached to the Royal Air Force in World War II. He was knighted in 1931. Particularly noted for his portraits, Rothenstein executed works in several media which showed the influence of Edgar Degas and James McNeill Whistler in his handling of masses and the diffusion of light. He wrote, among other books, "Life of Goya" (1900), "Form and Content in English Painting" (1934), and the autobiographical "Men and Memories" (3 vols., 1931-39).

